Intelligent Transportation Systems in the National Parks System and Other Federal Public Lands - 2011 Update

September 2011

Prepared for:

U.S. Department of the Interior

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U.S. Department of Transportation

Table of Contents

Acknowledgements

The authors wish to thank the numerous organizations and individuals who provided their time, knowledge, and guidance in the development of this report. A full list of individuals from FLMA units whom agreed to conduct interviews to verify inventory table findings and discuss ITS experiences is included in Appendix D. Other individuals of note who provided their time in the development of this report include:

Bureau of Land Management
Randy Goodwin

Fish & Wildlife Service
Nathan Caldwell

Metro Transit (St. Louis, MO)
Tera Kramer

National Park Service
Daniel J. Cloud
Jim Evans
Debra Frye
Elisabeth Hahn
John Hannon
Wayne J. Vander Tuin

Paul S. Sarbanes Transit in the Parks Technical Assistance Center
Steve Albert
Jaime Eidswick

U.S. Department of Transportation John A. Volpe National Transportation Systems Center
Kirsten Holder

U.S. Forest Service
Dan Hager

Acronyms

The following terms are used in this report:

AVL	Automatic vehicle location
BLM	Bureau of Land Management
CAD	Computer-aided dispatch and scheduling
CCTV	Closed-circuit television camera
CMAQ	Congestion Mitigation and Air Quality
DMS	Dynamic message sign
DOT	Department of Transportation
ESS	Environment sensor station
GPS	Global positioning system
GSA	General Services Administration
FLMA	Federal Land Management Agency
FWS	Fish and Wildlife Service
HAR	Highway advisory radio
ITS	Intelligent Transportation Systems
JPO	Joint Program Office
LED	Light-emitting diode
MDT	Mobile data terminal
MPO	Metropolitan Planning Organization
NPS	National Park Service
PCB	Professional Capacity Building
PEPC	Planning, Environment, & Public Planning
PMIS	Project Management Information System
RFID	Radio frequency identification
RSS	Really simple syndication
SMS	Short message service
TE	Transportation Enhancement
TIP	Transportation Improvement Plan
TRIP	Transit in the Parks Program
USFS	United States Forest Service

Intelligent Transportation Systems (ITS) in the National Parks System and Other Federal Public Lands – 2011 Update

Executive Summary

The "Intelligent Transportation Systems in Federal Public Lands" report details the state of ITS deployment across all federal land management agencies (FLMAs) in 2011, updating a Volpe Center report completed in 2005. An assessment of the types of ITS technologies in use by public lands units, the prevalence of the deployment of specific technologies, and the technical and institutional barriers towards the advancement of ITS involvement in public lands is included. The report identified little expansion of ITS technologies in recent years, outlining steps which can be taken to improve and further advance the use of ITS in public lands.

While ITS technologies continue to evolve and demonstrate positive results in transportation settings across the nation, there is considerably less enthusiasm over ITS use within public lands. Many of the ITS technologies with the greatest utility for public lands, such as dynamic message signs (DMS), continue their growth in deployment for a number of different types of units. However, complex operations, such as traffic monitoring, transit fleet management, and road-weather systems, are not providing the benefits to warrant deployments in locations where transportation-related issues are not substantial. Technologies which are rapidly coming into use, particularly within the traveler information field, are considerably less complex and easier to manage than many of these multi-component systems.

Despite the recent lack of advancement of ITS within public lands, there are a number of actions which can be taken to further improve the use of technologies out in the field and cultivate the use of newer technologies such as social media applications. Five technologies were identified to have displayed considerable past, present, and future utility for public lands: (1) DMS, (2) highway advisory radio (HAR), (3) 511 traveler information systems, (4) traffic counters and loop detectors, and (5) social media applications. Conversations with public lands staff pinpointed the most prevalent issues (highlighted in this Summary) relating to carrying out ITS projects and maintaining and operating systems.

The use of social media applications is seeing the most vigorous activity among all ITS technologies today. Popular social networking sites such as Facebook and Twitter have permitted units to share both interpretive and traveler-related information to visitors at off-site locations. This allows visitors to receive important information related to traffic delays, detours, alternative transportation options, and parking information. For conditions which can change on short-term notice, disseminating information through social media applications can be especially valuable, as mobile devices are becoming an increasingly common means of accessing this data. A lack of guidance from parent federal land management agencies has hindered the development of a social media presence among all public lands units. Many units which do not possess ample staff time or expertise to develop this media have turned to friends groups to cultivate a social media presence for them.

Working closely with local, regional, and state agencies, such as departments of transportation (DOT's), local governments, regional planning organizations, community development agencies, and public safety institutions, can be greatly beneficial for public lands units in strengthening their use of ITS. As the transportation issues affecting public lands units often overlap with the local transportation, planning, or public safety concerns of these agencies, arrangements to share institutional knowledge or ITS equipment itself are commonplace across the nation. Examples of equipment sharing include the lending of DMS's to public lands units for use during special events, or

to inform motorists of congestion on approach roads owned by DOT's. Another example concerns the use of regional or state-operated 511 systems, which can incorporate traveler-related information specific to public lands units. By integrating ITS operations within regional or state ITS architectures, units and partner agencies help bring about closer coordination to operate equipment in a more collaborative manner.

Public lands staff often do not possess the resources, such as time and knowledge, to operate large-scale ITS deployments successfully. It was widely experienced that small-scale interventions, such as the introduction of DMS's or traffic counters to a roadway, offer the most straightforward and cost-effective solutions to transportation issues. Employing an outside contractor to assist with deployment and ongoing operation, as well as following a systems engineering process throughout a project's lifecycle, are two well-utilized means to manage larger-scale ITS projects. In some instances where traffic and parking congestion occur on a regular, predictable basis, the cost of procuring and implementing elaborate management systems may be prohibitive, and visitors have come to tolerate these issues.

Other issues affecting ITS deployment and use within public lands concerns power and network connectivity. Owing to the rural nature of many units, inadequate power connections and network access can prevent many systems from functioning properly. Poor climate conditions and rugged terrain are other causes of power and connectivity issues. The inability of many ITS technologies to "talk" to one another also limits the effectiveness of ITS projects. Often, many technologies require manual input from staff to access data and function. Systems which can communicate to one another remotely can open staff labor and other resources for other tasks. Examples of this kind of coordination include the ability to input DMS messages from off-site locations, or automatically disseminate motorist alerts over multiple traveler information platforms (Twitter, DMS, HAR).

To help assist public lands units with procuring, deploying, and operating ITS, a multi-faceted national effort organized by FLMAs or the USDOT would be ideal. An ITS strategic plan would enable systematic planning, procurements, implementation, operation, maintenance, and evaluation of ITS projects, as well as allow FLMAs to focus on those technologies that produce the greatest results for individual units and regions. This strategic plan can help with efforts to improve procurement processes, such as by coordinating multi-device procurement and utilizing GSA-approved product lists, and in offering training opportunities to public lands staff, such as through professional capacity building and peer exchanges. Institutional knowledge is paramount in successfully operating ITS, as staff unfamiliarity with technologies can impede willingness and aptitude to use systems.

Introduction

After decades of perseverance, federal land management agencies (FLMAs), such as the National Park Service (NPS), Fish and Wildlife Service (FWS), Bureau of Land Management (BLM), and United States Forest Service (USFS), continue their joint missions to conserve America's public lands while providing recreational opportunities for the nation's enjoyment. Over the past quarter century, climate change and population encroachment threaten these twin missions of FLMAs. As America continues to grow and take advantage of the charms these recreational areas provide—635 million acres of federally-owned recreational land receive over a billion visits annually[1]—FLMAs seek to respond to these challenges in a sustainable manner, without taking from the landscape or further straining infrastructure systems. Over the past decade, public lands units have increasingly turned to intelligent transportation systems (ITS) to address the access, congestion, and environmental problems which risk tarnishing the visitor experience and damaging environmental resources.

> **Intelligent Transportation Systems (ITS)**
>
> *Definition:* ITS is the application of integrated information and communications technologies to infrastructure and vehicles in order to improve safety and better manage travel and travel choices.
>
> Over the past 20 years, ITS has transformed transportation safety, infrastructure, operational performance, and service delivery. ITS facilitates a connected, integrated transportation system that is information-intensive in order to better serve the interests of users, be responsive to the needs of travelers and system operators, and improve safety.
>
> Source: ITS Program Plan 2008, USDOT, December 2008 – http://www.its.dot.gov/its_overview.htm

The term "ITS" covers a series of technologies which aim to enhance our nation's transportation system, particularly in the areas of safety, mobility, and productivity. Most commonly, ITS refers to advanced wireless and wired communication technologies both within the transportation infrastructure and in vehicles. The U.S. Department of Transportation's (DOT) ITS Joint Program Office (JPO) defines 16 application areas for ITS, encompassing topic areas such as arterial management, transit management, emergency management, and "intelligent vehicle" functions such as collision avoidance.[2]

Many ITS technologies can assist in mitigating common transportation difficulties afflicting public lands units today. These issues are problematic because they both threaten to detract from the visitor experience and negatively impact environmental resources. Each issue has different origins, but all merit concern from public lands staff. Some of the chief problems are outlined below:

- *Overcrowding*—Especially at some of the more popular destinations, including units located within crowded urban settings, accessibility to units and mobility within units have become major problems that impact the visitor experience and can discourage visitation, tourism, and public support. Many units are particularly crowded during peak seasons and special events, when visitation (often greatly) exceeds the carrying capacity of the site during a particular week or at a certain time of day.

- *Congestion*—Seasonal traffic jams in heavily visited units limit the ability of visitors to access site resources and can result in a frustrating experience. In peak traffic periods, units that collect entrance fees often are faced with long queues, as visitors wait in line at the attendant gates. Additionally, air quality suffers as a result of increased vehicle emissions due to traffic congestion.

[1] U.S. Department of the Interior. (2011). *America's Great Outdoors: A Promise to Future Generations.* Retrieved April 6, 2011 from http://americasgreatoutdoors.gov/files/2011/02/AGO-Report-With-All-Appendices-3-1-11.pdf.
[2] Research and Innovative Technology Administration. (2011). *Intelligent Transportation Systems Joint Program Office.* Retrieved April 6, 2011 from http://www.its.dot.gov/index.htm.

- *Parking Problems*—As visitation increases, parking areas fill, prompting some visitors to create impromptu parking areas that can result in damage to sensitive unit resources unless staff are diverted from their other duties to direct traffic. Congestion is exacerbated when visitors circulate in their vehicles seeking vacant parking spaces. Tour and school-bus parking are also significant problems at many units, as is the need to ensure adequate accessible parking.

- *Lack of Traveler Information*—Timely and accurate information often is not available or not accessible to travelers to allow them to make informed decisions based on site traffic and road conditions, weather-related delays, facility closures, parking and/or lodging shortages, and available alternative transportation options. When traveler information is provided, it is usually targeted to a specific geographic area, even though unit visitors can begin their journey to a site from far outside that area. Although receiving information via wireless communication has become customary for many visitors, units still face policy, technical, and operational obstacles in developing and effectively utilizing these technologies.

- *Public Safety*—The ability to locate and assess incidents and provide timely emergency response services is crucial, particularly in remote locations. From a transportation perspective, public-safety needs exist in units that have the potential for vehicle (car, bus, train, ferry, aircraft, and bicycle) and pedestrian accidents. Unique public safety and security concerns by both staff and visitors alike also arise in public land units that are found in remote locations as well as in urban locations.

- *Resource Protection*—Transportation negatively impacts natural resources in several ways: vehicular exhaust emissions, traffic noise intrusion on the natural quiet and wildlife, vegetation damage from unauthorized parking, wildlife and human injuries and deaths from wildlife-vehicle collisions, fragmentation of habitats, and the land required for roadway and parking area construction and operations.[3]

Although not all ITS technologies in existence today bring relevant benefits to public lands units, many sites have utilized ITS to address the issues described above. Many units now employ ITS at various levels to observe and react to traffic, parking, weather, and emergency conditions; manage transit systems; disseminate traveler-related information to visitors before and during trips; and conduct vehicle and visitor counts. As technological innovations continue to occur and barriers to entry (such as cost and expertise) become easier to overcome, ITS will increasingly be seen as a more viable solution to transportation-related concerns within federal public lands.

Organization of Report

The majority of this report covers the ITS technologies which have relevance to the operation of public lands units. The technology reviews cover specific benefits received by the public lands from technology operations and ITS applications that are part of larger and more complex integrated systems. This document also examines the continued viability or growth of ITS in the public lands, including guidance for future deployments. This report is divided into several topic areas, summarized in the seven sections profiled below.

First, the **Project Background and Methodology** section covers past research efforts and the processes taken to carry out this report. Next, the **ITS Technologies Evaluated** section provides an overview of the 19 ITS technologies included for study in this report. The **2011 Inventory** introduces the current inventory table of ITS

[3] Ritter, G., Bent, E., and Plosky, E. (2006). *Intelligent Transportation Systems (ITS) in the NPS: 2005 Baseline Inventory and Preliminary Program Assessment.* John A. Volpe National Transportation Systems Center. p. 2-3.

technologies by public lands unit, as well as extensively covers the costs and benefits of five commonly-used technologies. The **Operational Findings** covers the most visible outcomes of project research and conversations with unit staff. **Recommendations Moving Forward** proposes action items for individual units and agencies to consider that will aid in the expanded utilization of ITS components as well as improving the effectiveness of existing and future transportation technologies. The **Technology Deployment Guidance** section presents a straightforward matrix identifying the best ITS technology fits for various public lands based on unit characteristics and existing conditions. Finally, a **Conclusions section** summarizes the current ITS planning and deployment status, findings and lessons gathered, and financial concerns before positing the logical future direction of ITS in public lands units over the next decade.

Project Background and Methodology

Past Research Efforts

This report updates the 2005 report - *Intelligent Transportation Systems (ITS) in the NPS: 2005 Baseline Inventory and Preliminary Program Assessment*. The 2005 report, prepared by the U.S. DOT John A. Volpe National Transportation Systems Center (Volpe Center), provided a baseline inventory of ITS applications in 59 NPS units across the nation. It discussed the state of ITS in the NPS in the mid-2000s, specifically the variety of ways in which parks approached the planning and use of ITS and future prospects for ITS in the agency. The report offered recommendations on advancing ITS technologies in the NPS, both within individual park units and as an agency-wide program.

The *2005 Baseline Inventory and Preliminary Program Assessment* established a number of conclusions regarding ITS conditions in the NPS. Only ten percent of the baseline inventory for ITS projects was considered to be complete, with traveler information technologies the most prevalent in use or under development by park units.[4] Despite the low level of ITS components being operational, interest in and usage of ITS within the NPS was strong and growing, with infrastructure already in place for a variety of field components such as highway advisory radio (HAR), dynamic message signs (DMS), and traffic counters. However, due to financial limitations, ITS deployments were pursued in a piecemeal fashion. The 2005 report stated that deployment and operations criteria and performance measures were needed for decision makers to accurately gauge the utility of evaluating current ITS projects and pursuing future ITS deployments.[5] Many of the conclusions from the *2005 Baseline Inventory and Preliminary Program Assessment* provided the context for the findings, best practices, and recommendations of this 2011 report.

Other research efforts related to transportation planning in the NPS, throughout FLMAs, and within other recreational settings were investigated for this report. Other sources were consulted relating to the planning and operation of ITS. Notable among these sources were a series of reports on ITS applications in California's national parks from the Western Transportation Institute[6] and the U.S. DOT's ITS JPO's Knowledge Resources database.[7] A full list of sources used in the research of this report can be found in Appendix E.

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[4] Ritter, G., Bent, E., and Plosky, E. (2006). *Intelligent Transportation Systems (ITS) in the NPS: 2005 Baseline Inventory and Preliminary Program Assessment.* John A. Volpe National Transportation Systems Center. p. 18.

[5] Ritter, G., Bent, E., and Plosky, E. (2006). *Intelligent Transportation Systems (ITS) in the NPS: 2005 Baseline Inventory and Preliminary Program Assessment.* John A. Volpe National Transportation Systems Center. p. 29.

[6] Western Transportation Institute. (2006). *Assessing Needs and Identifying Opportunities for ITS Applications in California National Parks.* Retrieved April 7, 2011 from http://www.westerntransportationinstitute.org/research/426126.aspx.

[7] Research and Innovative Technology Administration. (2011). *Intelligent Transportation Systems Joint Program Office—Knowledge Resources.* Retrieved April 6, 2011 from http://www.itslessons.its.dot.gov/its/itsbcllwebpage.nsf/krhomepage.

Study Methodology

To carry out data collection to update the baseline inventory, the Volpe Center expanded upon work completed as part of the *Intelligent Transportation Systems (ITS) in the NPS: 2005 Baseline Inventory and Preliminary Program Assessment*. Whereas the 2005 report covered only the National Park Service, this research expands the units analyzed to include all FLMAs, although resources available to identify ITS involvement in non-NPS units were much more limited.

This 2005 inventory organized ITS technologies under the categories of Travel & Traffic Management, Public Transportation Management, Maintenance & Construction Management, and General/Other. The updated baseline inventory largely borrows the conventions established in the original effort, although the Maintenance & Construction Management category was eliminated, and new Incident Management and Entry Management categories were established. These new categories and their corresponding technologies were modified or simplified to reflect the reality of the concentrated types of ITS applications in use by public lands units.

A number of technologies were introduced to the baseline inventory to reflect ITS advancement in public lands since 2005. Others were shifted between categories, slightly renamed to add more specificity regarding their uses, or eliminated altogether. Descriptions of each of the technologies analyzed can be found in the ITS Technologies Evaluated section.

TABLE 1: Comparison of 2005 and 2011 ITS Inventory - ITS Categories and Corresponding Technologies

ITS CATEGORY	2005 TECHNOLOGY	2011 TECHNOLOGY
Travel & Traffic Management	Variable / Changeable Message Signs	Dynamic Message Signs (portable & permanent)
	511 System Integration	511 System Integration
	Highway Advisory Radio	Highway Advisory Radio
	Trip Planning Tools	Trip Planning Tools (innovative)
	Automated Entry System	Loop Detectors / Traffic Counters
	Traffic Monitoring System	Integrated Traffic Monitoring System
	Parking Management & Availability	Parking Management & Availability
	Incident Management System	
	Weather / Road Condition Information	
	Travel Information - unspecified	
	Travel Information Kiosks	
	Reservation Systems	
Public Transportation Management	In-Vehicle Electronic Information	In-Vehicle Electronic Information
	Vehicle Tracking System	Vehicle Tracking System
	Transit Management	Automated Passenger Counters
	Fleet Management	Operations & Fleet Management
Maintenance & Construction Management	Road Construction Information	
	Work Zone Management	
Incident Management		Automated Road-Weather Information System
		Road Surveillance
		Work Zone Management
		Incident Management System
Entry Management		Automated Entry System
		Automated Fee / Fare Payment
Other / General	Integrate ITS with State / Local DOTs	Coordinate with Other Agencies
	ITS Needs Assessment	ITS Needs Assessment
	2005: 20 identified technologies	**2011: 19 identified technologies**

Although not included in the baseline inventory table, social media as unique information dissemination applications are summarized in separate activity tables and discussed in the findings of this report. Other technologies discussed with public lands representatives included wildlife detection systems and asset management systems. These two items are also not included in the inventory due to low level of deployment in public lands units.

Investigation of changes and additions to projects and technologies included in the 2005 baseline inventory was conducted through a variety of means and resources, which included:

- Statewide and regional ITS architectures - 92 statewide and regional architectures were examined to determine the presence of NPS or other public lands involvement. A list of the 19 architectures found to include public lands involvement can be found in Appendix C.
- TRIP grant proposals: Transit in the Parks Program (TRIP, formerly known as the Alternative Transportation in Parks and Public Lands Program) grants and proposals from 2006 to 2010 were reviewed for ITS-related projects and components within projects.
- Transportation Improvement Plans (TIP): Select regional TIPs and state TIPs were examined for public lands ITS projects.
- NPS Project Management Information System (PMIS): The PMIS was researched to identify potential ITS components of transportation projects.
- Public lands unit websites: Most notably, the status of technologies within specific NPS and other FLMA units included in the 2005 baseline inventory were revisited through official unit websites.
- NPS Planning, Environment, & Public Comment (PEPC) website: The technical ITS reports located in the PEPC website were consulted.[8]
- Other transportation plans and technical reports: An exhaustive search of transportation plans and technical reports containing ITS elements within NPS and other public lands agencies was also carried out.

In addition to the methods attempted above, conversations with staff from 13 NPS units and one USFS unit were carried out to verify technology listings, identify benefits attained and costs incurred from ITS deployments, discuss issues, concerns, and lessons learned, evaluate unit approaches, and gather impressions of ITS and any local, regional, or national actions needed to aid with ITS planning, deployment, and operations. The conclusions of these conversations form the basis for much of the research findings detailed in this study. The large number of NPS contacts is directly related to this report building upon the *2005 Baseline Inventory and Preliminary Program Assessment*, which focused on NPS exclusively. However, current research has shown that NPS involvement with ITS continues to be much more exhaustive than that of other FLMAs. Additional input from the regional offices of FLMAs were also sought as part of the inventory and findings development.

Much of the reported information is based on the subjective interpretation of what constitutes ITS from FLMA staff members. As such, the accuracy of research results featured within the inventory table is subject to error regarding which transportation-related technologies are actually operational. Although the 2005 report catalogs ITS technologies in the conceptual or planning phases, material could not be located noting further development of many these systems, and are thus listed in the baseline inventory as remaining in these stages. Although this categorization is likely correct in some cases due to project interruption or an inability to acquire funds for implementation, other instances have likely been brought to completion or scrapped altogether with little evidence to corroborate this.

[8] National Park Service. (2011). *Planning, Environment, and Public Comment.* Retrieved March 7, 2011 from http://parkplanning.nps.gov/.

ITS Technologies Evaluated

Profiles of Individual Technologies

The technologies chosen for this inventory were selected based on their pervasiveness throughout units, their overall utility to unit operations, and ease of carryover from the 2005 inventory table (differences between the two inventory efforts are discussed in the previous section). Individual technologies and the overarching categories by which they are associated are described below. The primary source of technology costs is the ITS JPO's ITS Knowledge Resources website and its associated databases.[9]

Travel & Traffic Management

ITS associated with travel and traffic management help alleviate the impacts traffic congestion, limited parking capacity, and traveler uncertainty may cause. Reduction or elimination of these impacts can be achieved through various technologies aimed to distribute information to visitors pre-trip, en route to, or within units, direct visitors along lighter-traffic roads or less-used entrances or attractions within a unit, or spread out visitation over a period of time. These technologies can be simple standalone equipment, such as traffic counters and dynamic message signs, or more complex applications such as traffic and parking monitoring and management systems.

- *Dynamic Message Signs (portable and permanent)*— Also known as variable message signs or changeable message signs, dynamic message signs (DMS) are electronic message boards located above or beside roadways used to communicate messages to passing motorists. DMS can also be used for transit or alternative transportation purposes. These devices can be permanently installed at one location or portable for use at multiple locations. DMS costs range from $15,000 for a trailer-mounted DMS to over $100,000 for a large permanent sign.

- *511 System Integration*—511 systems are regional or statewide information dissemination platforms, commonly used to alert motorists of travel advisories or promotion of area attractions. They are often operated by a statewide or regional transportation entity, such as a state DOT or a Metropolitan Planning Organization (MPO). Many individual public lands units are now listed as a destination point within 511 travel options. Additional coordination with the 511 systems manager is usually required to ensure that the relevant nearby 511 system(s) provide specific travel advisories or alerts related to unit-owned assets, including unit or road closures. Because these 511 systems have been developed and are managed by another agency, costs to the public lands units are minimal for initial connection into the 511 system and ongoing dissemination of information (in a predetermined method by the 511 manager).

- *Highway Advisory Radio*— Highway advisory radio (HAR) systems broadcast traveler-related information to motorists using low-power permanent or portable radio stations on AM radio. Although HAR systems are typically the domain of regional or state transportation entities, units can acquire broadcast signals to alert motorists of travel advisories within and in proximity of the public lands unit. HAR costs range from $15,000 for a 10-watt powered HAR system to just under $50,000 for a super HAR with a larger antennae and stronger signal.

- *Trip Planning Tools (innovative)*—Although trip planning tools, such as printed or downloadable travel guides, have increasingly become the norm among units, innovative trip planning tools are more interactive in nature, and may include rich internet applications such as Flash or Java or partnerships with nearby attractions for tourism-oriented campaigns. Additionally, a large number of regional trip planners are now integrated within 511 websites. The intricateness and complexity of trip planners varies widely, contingent

[9] U.S. Department of Transportation, Research and Innovative Technology Administration, ITS JPO – I*TS Knowledge Resources website*. http://www.benefitcost.its.dot.gov/its/itsbcllwebpage.nsf/krhomepage.

upon the level of information rendered and number of (private and/or public) partners involved. As such, estimating the costs of dynamic trip planners is difficult, but public lands units should not expect to shoulder the burden of costs if partnering as part of a wider tourism effort. The technical complexity of installing and operating trip planners and competing responsibilities of staff typically necessitates the use of a contractor or passing off of much of these actions to a project partner. Basic web-based trip planners can be developed for less than $200,000 and require annual operations and maintenance support of $10-$25,000 (5-10% of development costs). Enhanced trip planners will require integration with multiple other databases and information systems and regional or statewide systems have cost up to $2.5 million to design, implement and first year operation.

- *Loop Detectors/Traffic Counters*—There are a variety of different methods for obtaining traffic counts, ranging from pneumatic tubes embedded in roadways to closed-circuit television cameras (CCTV) and acoustic or infrared sensors. Although this designation covers any type of traffic counting system in use by a unit, including counts from traffic control gates, loop detectors are the most widely used technique. These work by embedding metal loops in pavement to detect the electro-magnetic field emitted by passing vehicles. Traffic counter systems range from $3,000 per site for inductive loops to over $30,000 per site for camera sensors. Costs for other types of vehicle sensors - acoustic, microwave, infrared - fall within the basic inductive loop and expensive camera sensor ranges. In addition to obtaining vehicle counts, FLMAs may also be interested in collecting automated bike and pedestrian counts. Costs for bike and pedestrian detection and crossing illumination system at crosswalks or trail heads run from $8,000 for a detection and flashing pedestrian sign up to $16,000 per intersection for detection and in-pavement crosswalk illumination. These sensors can be adapted to record counts when activated.

- *Integrated Traffic Monitoring System*—Traffic management systems work by alerting staff and visitors of road corridors with high congestion, encouraging parties to seek alternate routes or adjust travel plans in some other manner. The connection from the monitoring equipment in the field (e.g., loop detectors, CCTV) to a management or operations center, and from a center to the information dissemination equipment (e.g., DMS, HAR, 511, website), is what makes this technology unique from non-linked technologies. These systems can also be critical components of an incident management system.

  CCTV cameras range in price from $4,000 up to $20,000, with an additional $4,000 to $13,000 for camera towers ranging in height from 35 to 90 feet. The costs for a communications or operations center, including hardware, software and communication lines, varies greatly and has easily exceeded millions of dollars in many metropolitan areas. However, the communications center at a public lands unit can be much more basic and housed at a typical dispatch workstation. Workstation modifications with the necessary hardware, software and related communications infrastructure can be attained for less than $100,000, depending on the functional expectations of the monitoring system.

- *Parking Management/Availability*—Parking management systems monitor the availability of spaces at parking facilities. Often parking management information is used to encourage visitors to seek other parking destinations, use alternative transportation, or both. These systems rely on parking capacity counters either at the entrance/exit gates, space sensors, or both. Parking space sensors run from $250 to $800 per space, while the automated control gate and accompanying software could cost up to $55,000.

Incident Management

Incidents which affect transportation flows into and out of, through, or even around a public lands unit can greatly disrupt operations and activities occurring within that site. Medical emergencies, disabled vehicles, disruptions caused by natural disasters (e.g. fallen debris, flooding), and "non-emergency" tourist actions (e.g., wildlife viewing “bear jams”, excessive unauthorized parking) can have strong implications on visitor safety and satisfaction and disrupt the transportation network. Units have a number of technology options available to prevent, respond to, and mitigate or lessen the damages brought on by detrimental transportation-related events.

- *Automated Road Weather Information System*—Sensors or other devices embedded within or located beside roadways can detect dangerous driving conditions, such as ice build-up, snow accumulation, or water intrusion, alerting unit staff so maintenance crews can be dispatched, roads closed, and drivers warned. Environmental sensor stations (ESS) are the primary piece of equipment used to monitor weather conditions. Information dissemination of road conditions utilizes DMS, unit websites, and 511 systems. Variable speed limit signs have been used to control traffic based on travel conditions.

  ESS are prevalent at many public lands units, but most are not currently applied as road-weather sensors. The most basic weather station can be purchased for just over $10,000, but the standard ESS costs approximately $45,000. Communication links to an operations center could add $10,000 or more to system costs.

- *Road Surveillance*—Road surveillance comprises CCTV and other video recording devices to monitor traffic activity on a roadway. Unlike similar devices which can be used as traffic counters, this distinction covers cameras which supervise roadways for motorist safety purposes. As identified previously, CCTV video cameras range in price from $4,000 for indoor units up to $20,000 required in locations of extreme weather conditions or to obtain the greatest picture resolution. Camera towers add up to $13,000 (for a 90-foot structure), depending the height needed.

- *Work Zone Management*—Work zone management is a comprehensive series of measures to alert motorists of roadway construction, mitigate travel delays and hardships, and ensure the safety of work crews. This distinction covers multiple strategies used in conjunction with one another, although individual components include:
  - Information dispersal on construction and delays using DMS (primarily portable), HAR, unit websites, and 511 systems;
  - Enforcement of reduced speed limits using work zone detection sensors and warning systems, variable speed limit signs, and CCTV monitoring cameras;
  - Visual warning and directional devices, especially lighted devices, for night-time road work, using illuminated smart traffic cones and dynamic lane merge systems.

  Capital costs for work zone ITS equipment range from $150,000 to $500,000, based on experiences of a number of state DOTs. One consideration is that most of the components employed for work zone sites are capable of being applied to other functions before and after use. In reality, many of the smaller work zone management components can be implemented as stand-alone devices to achieve similar goals and significantly reduce capital costs.

- *Incident Management System*—This system utilizes a coordinated combination of the components listed above and other measures to reduce the level of incidents occurring on roadways and respond quickly to those which have. A comprehensive system includes field and office devices that enable surveillance and detection, mobilization and response, information dissemination, and clearance and recovery of incidents. A successful incident management system should include close coordination with local and regional emergency responders and communication with local law enforcement or media to discourage travel on impacted roadways. This requires pre-planning and protocol agreements.

Entry Management
Long queues at unit entry gates are undesirable for a number of reasons. For visitors, more time spent waiting to enter a unit means less time spent within a unit. Employees of a unit may also become held up in line, placing a strain on staff resources. Employing advanced entrance fee payment methods, such as with toll-tag, magnetic stripe, or smart-card technology, can drastically reduce these issues. These technologies can also collect more accurate information on park usage and visitation patterns.

- *Automated Entry System*—This technology includes measures to manage vehicle flow in and out of a unit, as well as control access by vehicles to certain parts of the public lands unit. This technology enables employees or others who regularly enter a public lands unit (delivery trucks, residents, transit vehicles) to bypass payment processes at entrance gates. In addition, manual or remote-controlled gates can be controlled in conjunction with weather or incident closures, or when transportation networks reach critical mass in specified areas. Although this system can include automated entry methods such as radio frequency identification (RFID) transponders or smart-card technology, it also comprises simpler methods such as entry gates or other methods to detect special visitors who do not need to stop at entrance gates. Entry gates can run over $100,000 per location dependent on the functionality of the control device.

- *Automated Fee/Fare Payment System*—Automated or electronic fee/fare payment systems use toll-tag, magnetic stripe, or smart-card technology to allow visitors more convenient and efficient payment methods when entering the unit and using unit services. The National Park Pass is a working example of operational smart card technology. Technologies employed with these payment systems include electronic tag readers at entrance stations (approximately $4,000 per lane) on the highway side, and on-board smart card collection systems (up to $20,000 per vehicle) and fare vending machines (up to $65,000 per vehicle) for transit operations.

Public Transportation Management
In public lands units with transit systems, ITS technologies can be deployed to bring about the more efficient operation of these systems and assist visitors in adeptly navigating the service. These technologies aid in keeping vehicles on schedule and providing information to passengers on vehicle arrival times and locations. Vehicle location technologies, on-board information systems, and computer-aided dispatch and scheduling are common ITS applications in this field.

- *In-Vehicle Electronic Information*—Transit vehicles are equipped to provide information within vehicles electronically, without the use of the driver or dispatch operator. This can include the automated annunciation of transit stops or electronic display boards notifying passengers of stops or other information. On-board passenger information systems typically cost in the $4,000 per vehicle range.

- *Vehicle Tracking System*—An automatic vehicle location (AVL) system is a computer-based vehicle tracking system that uses specific location technology (usually global positioning system - GPS) and a method of transmitting the real-time location of any receiver-equipped vehicle to a dispatch center to monitor the flow of vehicles. This information can also be archived to allow for the evaluating of system performance. With this technology, transit stops can also be equipped with message boards notifying waiting passengers of bus arrival times. AVL/GPS devices cost between $500 and $2,500 per vehicle. Transit status information signs usually found at interior or covered locations can cost from $4,000 to $8,000 per location. The real-time processing hardware and software housed at a control or operations center can run from the low $10,000s at a single simple workstation to over $1,000,000 for complex, multi-functional systems needed at the largest public transportation agencies, but not the scale needed at public lands units. Logically, AVL/GPS applications are not limited to transit vehicles but can apply to all fleet owned and/or operated by a public lands unit.

- *Automated Passenger Counters*—Automated sensors within transit vehicles can record passenger boarding and alighting, information which can be used to assess the suitability of transit stop locations and route characteristics. Passenger counter technology varies from less than $1,000 to more than $10,000 per vehicle, based on type and sensitivity of the sensors as well as the associated hardware and software.

- *Operations and Fleet Management*—This technology utilizes a comprehensive set of measures to continually refine transit operations through extensive data collection and strict monitoring of transit operations. Most often, successful operations and fleet management in a public lands setting involves computer-aided dispatch and scheduling (CAD) systems to identify and respond to gaps in service and ensure efficient operation of vehicle fleets. Fleet management equipment includes mobile data terminals (MDTs), which are small communication boxes in the vehicles that allow a wide level of data collection and real-time communications with the vehicle operator. MDTs cost between $1,500 and $5,000 per vehicle. Vehicle (or remote) diagnostics continuously check the condition of fluids and vehicle components and can be procured for around $2,000 per vehicle. Finally, a CAD system for small fleet and limited route operations, such as those found in public lands, can be purchased and installed for $25,000 to $50,000.

Other

- *Coordinate with Other Agencies*—Public lands units which regularly communicate and strategize transportation investments and strategies with local, regional, or statewide transportation entities often do so to jointly manage and operate ITS infrastructure (or systems, such as a transit system, featuring ITS technologies), discuss future ITS investments, and share knowledge. For instance, development of open communication among regional agencies is key to an efficient incident or emergency management process, as well as improved traffic or congestion management at unit ingress and egress points in surrounding areas.

- *ITS Needs Assessment*—Public lands units which have conducted a comprehensive needs assessment evaluating unit transportation systems and gauging the short and long-term need for ITS. Needs assessments typically result in short and long-range plans to develop and enhance transportation systems through ITS. An ITS architecture can be a logical outcome of a needs assessment plan or a stand-alone product created from regional, multi-agency coordination.

  An ***ITS architecture*** is a specific, tailored framework for ensuring institutional agreement and technical integration for the implementation of ITS projects or groups of projects in a particular geographic area, region, mode, agency, corridor, or project.[10] An ITS architecture functionally defines:

  - The *functions* that are *required* for ITS (e.g., gather traffic information, request a route, identify an incident, provide information to the public).
  - The *physical entities* or *subsystems* where these functions reside (e.g., in the field, on the vehicle, within an operations center).
  - The *information flows* and *data flows* that connect these functions and physical subsystems together into an integrated system (what information is exchanged between them).

[10] U.S. Department of Transportation. (2009). *National ITS Architecture.* Retrieved April 7, 2011 from http://www.iteris.com/itsarch/index.htm.

Although public lands units should be included as stakeholders in regional or statewide ITS architectures, involvement varies. In some instances, detailed analysis of the ITS implementation of specific units is outlined. In others, agencies such as the NPS and USFS are listed as a stakeholder with no indication given to specific units in the area. Furthermore, many ITS architectures completed or updated since 2005 do not feature public lands agencies or units as stakeholders. Of those architectures which do highlight ITS involvement in public lands, an incomplete picture of project engagement with the surrounding region is all too often the case.

The lack of updated regional and statewide ITS architectures deprives prospective public lands units of possible blueprints for planning and implementation of their desired ITS technologies. The ITS regional architecture process provides significant opportunities for a public lands unit to receive technical expertise and guidance from many regional and statewide players, specifically MPOs, state DOTs, and these agencies' associated consultants. It also provides a forum for the region to learn of the public lands unit's functional and technical needs, as well as an opportunity for the unit to develop partnerships and technical transfer relationships with the other public entities.

2011 Inventory

Inventory Table

The inventory table is presented in its entirety in Appendix F. This table captures the status of various ITS initiatives throughout FLMAs assembled over the course of project research. The baseline 2005 NPS-ITS Inventory was expanded based on document research and unit and agency representative interviews conducted in 2010 and 2011. The project team recognizes that although this ITS inventory is the most extensive compiled, it still does not include every DMS, innovative trip planner, or other ITS component that is being planned or in operation within the very large number of individual public lands units. Expansion of this ITS inventory should be seen as an ongoing task that will continue to improve the national ITS coordination, planning, and deployments, all within the larger context of more efficient and effective transportation networks within public lands units.

Prevalent Technologies

While there are many useful technologies that can be used for public lands units, the ITS inventory and interviews conducted identified five technologies that have shown very promising results for those units using them. Expanded details concerning each of these technologies are presented. These ITS technologies include:

1. Dynamic Message Sign
2. Highway Advisory Radio
3. 511 System Integration
4. Traffic Counters and Loop Detectors
5. Social Media Tools

1. Dynamic Message Signs

Overview: Dynamic message signs, both portable and permanent, are the most prevalent technology in use by public lands units today. 25 units identified in the 2011 inventory currently utilize the technology, but the relative inexpensiveness and widespread use of such systems by transportation agencies across the nation likely denotes more extensive use of this technology in recreational settings than captured by the inventory table. DMS are used to convey important messages to travelers prior to entering or within units. Commonly expressed messages include news about road closures, locations of parking lots, frequencies of unit radio stations, and information regarding alternative transportation services. They are often cited as a means to communicate important messages to a large segment of users at a small cost and with minimal labor.

System Information: There are both portable and permanent DMS. Portable systems are much more pervasive in public lands due to their multi-purpose applications. They can cost on average between $18,300 and $24,000, which includes a trailer, solar or diesel power generation, and a cellular modem for remote communication and control. Yearly operating costs range between $600 and $1,800 for labor and replacement parts. Portable DMS are relatively easy to install and operate[11] and can be easily transported to where they are needed, permitting remote or manual uploading of a message for immediate display. A stand-alone power source is needed for this technology; solar panels are a commonly-used means for this, although their effectiveness can be limited by local climate conditions.

Permanent DMS are less common in public lands settings due to their higher cost and immobility. Average costs for permanent DMS vary between $47,000 and $117,000, not including installation, although costs are likely to be on the lower end of that spectrum for signs along the arterials commonly seen in public lands. Yearly operations and maintenance can cost between $2,300 and $6,000.[12] Like portable deployments, permanent DMS require a stand-alone power source or hardwire power brought to the DMS foundation. Permanent DMS have a useful life of about 10 years, whereas portable units have a useful life of about 14 years.[13]

FIGURE 1 Dynamic message signs can be either portable, for use in multiple locations, or permanent fixtures at a specific location.

Picture source: **Prince George's County, Maryland. (2011). *Portable Dynamic Message Signs*. Retrieved July 14, 2011, from http://www.princegeorgescountymd.gov/Government/AgencyIndex/DPW&T/PGCTRIP/portable.asp**
Picture source: **Acadia National Park, photo by USDOT Volpe Center**

Benefits: DMS, especially portable units, hold a number of benefits for units. They can be deployed on short notice, allowing staff to notify visitors of important transportation or visitor-related issues as they arise. Many systems can be operated remotely, allowing staff to change messages without visiting the DMS itself. They can be moved, allowing park staff flexibility to deploy DMS as they see fit. Compared to other technologies, they are relatively

[11] U.S. Department of Transportation. (2009). *ITS Unit Costs Database.* Retrieved March 10, 2011 from http://www.itslessons.its.dot.gov/its/benecost.nsf/images/Reports/$File/CostElements%202009-10-30.pdf.
[12] U.S. Department of Transportation. (2009). *ITS Unit Costs Database.* Retrieved March 10, 2011 from http://www.itslessons.its.dot.gov/its/benecost.nsf/images/Reports/$File/CostElements%202009-10-30.pdf.
[13] U.S. Department of Transportation. (2009). *ITS Unit Costs Database.* Retrieved March 10, 2011 from http://www.itslessons.its.dot.gov/its/benecost.nsf/images/Reports/$File/CostElements%202009-10-30.pdf.

inexpensive and not difficult to maintain. Finally, they require very little effort on behalf of the user to interpret the message (users do not have to call a number, visit a website, or tune to a radio station).

Issues and comments: Reliable power generation for signs can be difficult to acquire in areas with significant cloud cover or rugged terrain. Additionally, although some systems feature the ability to upload messages from an off-site location, interviewees commented that this capability is prone to failure. Finally, there are aesthetic and compatibility concerns as with other "foreign" equipment located in pristine settings.

2. Highway Advisory Radio

Overview: HAR systems use low-power permanent or portable radio stations on AM radio to broadcast traveler or visitor-related information to motorists or other AM listeners within a limited geographic area. Messages can be recorded by unit staff or through a commercial vendor, although using an outside contractor offers considerably less flexibility in changing messages over a defined timeframe. According to the 2011 inventory, 21 units are currently utilizing the HAR technology.

FIGURE 2 Highway advisory radio systems, like this one at Shenandoah National Park, can inform visitors of traveler-related advisories

Picture source: **Federal Highway Administration. (2008).** ***Wildlife-Vehicle Collision Reduction Study: Report to Congress*****. Photo by copyright of Marcel Huijser, WTI. Retrieved July 14, 2011, from** http://www.fhwa.dot.gov/publications/research/safety/08034/05.cfm

System Information: The cost of a single 10-watt highway advisory radio unit ranges from $15,000 to $35,000. This cost includes a processor, antenna, transmitters, battery back-up, cabinet, rack mounting, lighting and mounts, connectors, cable, and license fee. A larger antenna for a stronger signal can cost an additional $9,000 to $10,000. Annual operations and maintenance runs $600 to $1,000. Use of a commercial vendor may incur additional costs, although installation of a broadcasting device (which can include establishing connectivity and land clearance) may be managed in this arrangement. A single HAR sign with flashing beacons notifying motorists of a message has a capital cost of $5,000 to $9,000. The useful life of an HAR unit is approximately 20 years, with an HAR notification sign lasting approximately 10 years.[14]

Benefits: An HAR allows motorists to receive important transportation or unit-related messages. It can be particularly effective in situations where conditions are constantly shifting, such as during a severe storm. If no transportation or unit-related advisories are active, messages transmitted over the system can inform visitors of parking information or interpretive information. A number of unit representatives remarked that the flexibility in broadcast content of HARs makes it a great functional asset.

Issues or Comments: Part of the challenge of using HAR as a communication technology is that it requires effort on behalf of the user to tune into a station and interpret a message. This differs from a DMS, which can be understood with very little effort on behalf of the user. The broadcast signal may also be difficult to pick up in mountainous terrain or when the HAR signal is extremely weak. It has also been observed that in an age of ubiquitous internet connectivity, visitors are becoming less likely to utilize a more antiquated technology like HAR. Indeed, some interview participants remarked that visitors no longer see the value of an HAR service.

3. 511 System Integration

Overview: Regional or statewide 511 traveler information systems allow units an opportunity to propagate traveler-related information to motorists prior to visiting, en route to, or within sites. Sixteen (16) units in the inventory are linked into a 511 program. Although the standard dissemination platform for this technology is the 511 telephone number, other means such as websites, traveler information kiosks, and TV and radio programs have all played roles in successful deployments as well. As of December 2010, there are 42 active 511 systems across the nation.[15] These 511 systems are listed in Appendix B. Information that is commonly transmitted over 511 systems includes weather forecasts, construction updates, nearby incidents, traffic congestion, and public transportation information.

System Information: Planning, design, implementation, operations, and maintenance of a 511 system is typically under the authority of a regional or statewide entity, such as a DOT. When integrated into a 511 system, public lands units are typically not responsible for any costs other than minimal staff time for coordination and dissemination to the 511 information service provider. To be connected into an existing system, public lands units need to work closely with system operators to establish standards for reporting information. A solid working relationship with the operating entity is beneficial in ensuring that the unit keeps active with any changes to the 511 system's operations, dissemination platforms, or internal policies.

Benefits: Due to the inexpensive nature of the service, linking into a 511 system is an economical way of distributing relevant traveler-related information to visitors prior to their visiting a unit. As sites often must work with transportation agencies such as a state DOT to institute other transportation enhancements (such as the posting of a sign), establishing a strong working relationship through the operation of a 511 system may have indirect benefits in coordinating other mutual transportation-related goals.

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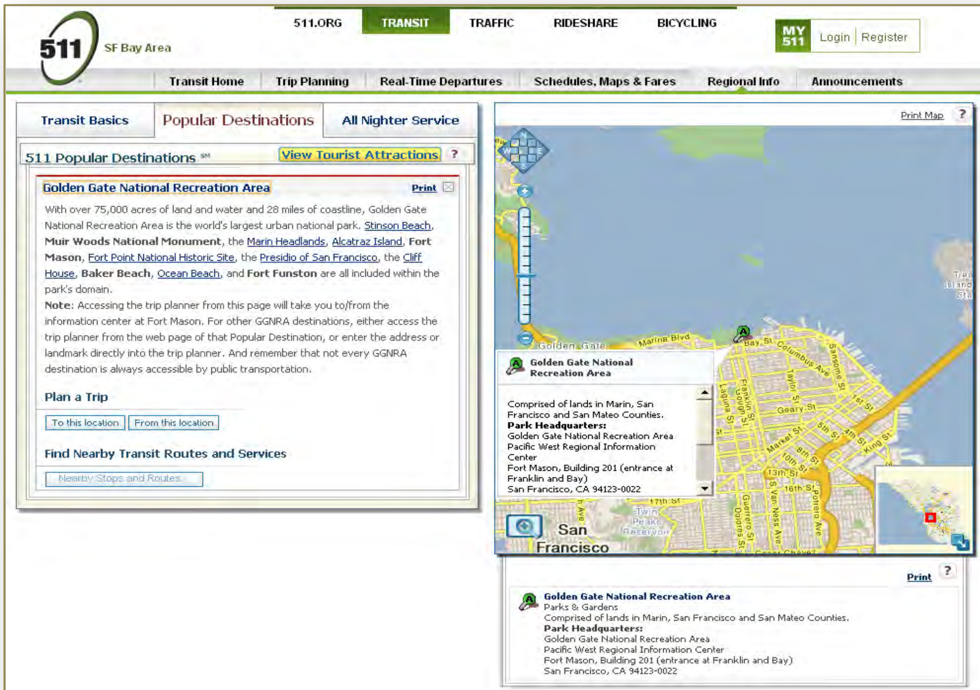
[14] U.S. Department of Transportation. (2009). *ITS Unit Costs Database.* Retrieved March 10, 2011 from http://www.itslessons.its.dot.gov/its/benecost.nsf/images/Reports/$File/CostElements%202009-10-30.pdf.

[15] Federal Highway Administration. (2011). *511—America's Traveler Information Telephone Number.* Retrieved March 11, 2011 from http://www.fhwa.dot.gov/trafficinfo/511.htm.

FIGURE 3 The San Francisco Bay Area's 511 system, operated by the Metropolitan Transportation Commission, incorporates the Golden Gate National Recreation Area and other natural attractions in the region



Picture source: Metropolitan Transportation Commission. (2011). *511 SF Bay Area*. Retrieved July 14, 2011, from http://511.org/

Issues or Comments: Although awareness of 511 as a source for traveler information is widespread, use of the system may be limited. Like HAR, 511 may be perceived as an outdated dissemination platform in an increasingly connected society, and internet users may not think to visit a 511's webpage when searching for travel conditions. The languid process of acquiring information using the telephone service may inhibit use as well, as some time and effort scrolling through the 511 phone line options is required of the user. Along those lines, recent efforts by the U.S. DOT to limit the use of cellular phones while operating a motor vehicle (distracted driving) contradict the real-time benefits of a 511 service.

4. Traffic Counters and Loop Detectors

Overview: Traffic counting devices have assumed a widespread presence on unit roads across the nation due to their low capital and operating costs, uncomplicated installation process, and ability to derive useful visitation statistics. The 2011 inventory lists 24 units as possessing this technology, but this number likely undersells the true presence of traffic counters at sites due to the small-scale nature of the technology not being actively highlighted in literature. Traffic counting technologies come in a variety of forms, the most common for public lands units are loop detectors. These work by embedding metal loops in pavement to detect the electro-magnetic field emitted by passing vehicles. Pneumatic tubes, CCTVs, and acoustic or infrared sensors are other widely-used traffic counting technologies, although the specifics of these technologies are not profiled in this report.

System Information: For installations along corridors, the cost of a two-pair (four-loop) system will range between $3,000 and $8,000 per location, with an intersection running about twice this range. These costs cover a completely integrated system, including communications, a processing units, and a central computer. Annual maintenance costs average around $500 per location. The useful life of a system is typically five years.[16] Many units have taken advantage of scheduled road maintenance projects to install (or repair) loop detectors and other traffic counting devices as part of this work.

FIGURE 4 Loop detectors, signified by the black wires embedded in the pavement at the intersection below, are a common type of traffic counting device

Picture source: **U.S. Traffic Corporation. (2003). *Vehicle Detector Loop Installation Guide*. Retrieved July 15, 2011 from** http://www.ustraffic.net/technotes/loopguide.pdf

Benefits: Compared to similar technologies, loop detectors are relatively inexpensive to purchase and maintain. Installation can occur in a short amount of time, and devices are hidden from view. They are also fairly accurate, estimating vehicle counts to within a 5% margin of error.[17] In general, traffic counting systems are able to provide very useful data at a minimal cost and with less upkeep than other ITS applications. As their use is so widespread among all transportation entities, a broad level of knowledge of the different methods to obtain traffic counts and operating loop detectors and other devices is available from a number of agency peers, as well as with state DOT personnel and U.S. DOT Federal Lands Highway staff.

Issues or Comments: For loop detectors, traffic data is limited to vehicle count and size. Information on passenger loads cannot be acquired using data from loop detectors, although in some systems speed data can be calculated. The environment that loop detection or other traffic counting systems operate within can greatly influence results.

[16] U.S. Department of Transportation. (2009). *ITS Unit Costs Database.* Retrieved March 17, 2011 from http://www.itslessons.its.dot.gov/its/benecost.nsf/images/Reports/$File/CostElements%202009-10-30.pdf.
[17] Ritter, G., Crowder, M., et al. (2003). *Gateway National Recreation Area—Sandy Hook Unit Parking Management Study*. John A. Volpe National Transportation Systems Center. p. 10.

As will be discussed later in this report, local terrain and climate conditions can impact power and connectivity issues at a site, without which traffic counting devices cannot register data. For other counting technologies, ambient noise and inclement weather can also reduce effectiveness. Finally, there may be aesthetic and compatibility concerns as with other “foreign” equipment sited in pristine settings.

5. Social Media Tools

Overview: Social media tools are becoming an increasingly accepted and expected way of distributing information to visitors prior to and during visits. The growth of smart phone use among visitors and the popularity of social media applications, such as Facebook and Twitter, allow units inexpensive and simple ways to alert visitors of transportation-related conditions and advisories, as well as communicate interpretive information to enhance the visitor experience. The use of social media by units was not measured as part of the 2011 ITS inventory due to the pervasiveness of the technology, the subjectivity involved in assessing successful uses of these technologies, and the wide range of applications of the social media deployed, most not specific to transportation. However, Appendix G does provide an extensive list of public lands units that deploy social media.

System Information: A number of social media platforms exist, and although they are all free to use, significant staff time may be necessary to ensure that these are best utilized and updated. The most prevalent social media applications in use today are described below:

- **Twitter:** A social networking and micro-blogging service, Twitter enables users to send and receive user updates known as “tweets”—text posts limited to 140 characters in length. Tweets are posted on the user’s profile page and delivered to users who have signed up to “follow” the particular user. Twitter is accessible via the Twitter website, short message service (SMS), really simple syndication (RSS) feeds, or through a number of proprietary mobile applications.
- **Facebook:** With approximately 600 million users worldwide, Facebook is the most widely used social media website. Facebook users develop a user profile, entering demographic information, personal interests, and contact information. Users can connect with friends, send messages, update their personal profiles, and join organized networks (e.g. workplace, college). Users can also create and join interest groups and "like pages”. Facebook enables users to share and distribute multimedia content such as pictures, videos, and web-links.
- **Youtube:** You Tube is a video-sharing website on which users can upload, share, and view videos. This free service enables users to create profiles, “subscribe” to user channels, and comment on user media. A number of public institutions such as state DOTs, metropolitan planning organizations, and local governments distribute public advisories, commercials, and other video-content on official pages.
- **Flickr:** Primarily known for its image hosting capacity, Flickr has recently expanded its service to permit users to upload videos. In addition to being a popular website for users to share and embed personal photographs, the service is widely used by bloggers to host images that they embed in blogs and social media.
- **Blogs:** A blog (web log) is a website that contains regular entries or “postings” submitted by an individual or organization. Blogs are usually tailored to a specific subject matter and feature multimedia content in addition to text. Blogs are typically interactive, permitting visitors to the site to leave comments and message other users through “widgets” on the site.[18]

[18] Jackson, D., Cotton, B., et al. (2010). *Sandy Hook Traveler Information System.* John A. Volpe National Transportation Systems Center. p. 7.

Benefits: Social media applications represent an excellent opportunity for units to communicate information in a user-friendly way to visitors. Visitors *en route* to a unit can use the internet to acquire information about the site or receive traffic and weather updates. Start-up costs are minimal—unlike many other ITS applications, there is no large-scale equipment purchase necessary. Messages can be changed at little notice without conversing with an outside contact. With minimal training required, most staff will be capable of managing the social media applications for a public lands unit. Responsibility for all potential social media applications should not overload a single staff member. Even when not posting traveler-related information, regularly updated social media applications act as a promotional tool for public lands units to engage with both potential and frequent visitors.

FIGURE 5 Glacier National Park hosts one of the National Park Service's most popular Facebook pages, with over 80,000 followers as of July 2011

Picture source: Glacier National Park. (2011). *Facebook page*. Retrieved July 14, 2011, from http://www.facebook.com/GlacierNationalPark

Issues or Comments: Many units have been slow to adopt social media technologies due to concerns about the staff time and technical expertise necessary to operate such systems. A protracted absence of upper-level guidance from FLMAs in using social media further compounded this issue. Many existing social media accounts for public lands units, particularly those using Facebook and Twitter, are not regularly updated, or have been outright abandoned. When this occurs, these pages appear unattractive and are considered inadequate to the user; whereas with regular attention, social media technologies can be quite beneficial for units. Established responsibilities regarding which staff members will handle which responsibilities, as well as a strong higher-level commitment from park management to push forward with social media use, can help ensure effective utilization.

How Parks are Utilizing Technologies

It was commonly observed throughout the research effort and discussed in interviews with unit staff that individual ITS technologies are often used for multiple purposes. A prime example of this is the various potential applications for DMS. These can be used to inform travelers of traffic or parking-related advisories, upcoming road construction times, delays due to incidents, and the advertisement of special events. Thus, while DMS exist as a stand-alone technology in the inventory table, they are important elements of several other ITS technologies and systems.

Other examples of multiple utilization of ITS technologies abound in public lands units. Entry management systems allow for the electronic handling of gate fee payments and control the flow of vehicles in and out of a unit, but can also serve as a good location for the installation of traffic counting devices. Loop detectors and other traffic counters, assessing both parking capacity and road congestion, improve the reporting process by supplementing visual counts by staff. CCTVs can monitor traffic capacity and congestion as a traffic management system or parking management system, serve as safety and security components within an incident management system, or provide live feeds direct to a 511 system website. A GPS unit or automated vehicle tracker and mobile data terminals can be used in both transit settings and for unit-owned ranger or maintenance vehicles, which enhance the coordination, communication and safety for operations in remote and potentially dangerous locations.

Operational Findings

Findings Related to Operating and Maintaining ITS

The uniqueness of each public lands unit presents different challenges when attempting to install ITS systems and keep them functional. As many units approach and operate technologies in different ways, consensus on the proper ways to operate and maintain ITS is lacking. The methods in which units install and implement systems is also not consistent throughout the field, especially in the case of more complex systems that often require more deliberation and preparation than many units ultimately commit. The following findings detail how public lands units are approaching the operation and maintenance of their ITS technologies.

Power Supply: Unsatisfactory power and network connectivity is one of the biggest obstacles facing units in operating ITS. Systems which require the provision of a standalone power source, such as an HAR receiver or a DMS, or require communication between separate pieces of equipment, such as a traffic loop and modem, can experience power and network connectivity issues. These issues are compounded in units with mountainous terrain and volatile climate conditions. In these settings, network signals are unable to travel far distances and equipment can malfunction in shifting weather conditions. For instance, solar panels are considered an effective source of power for a standalone piece of equipment (most commonly in the southwest and other sunny climates), but in many public lands settings there is not enough sunshine due to shade from nearby trees or local climate conditions. Additionally, aesthetic considerations often restrict staff from erecting new pieces of equipment, such as a reception tower, to improve connectivity.

FIGURE 6 In the right climates, solar panels can power ITS equipment, such as this animal detection system at Yellowstone National Park

Picture source: **Federal Highway Administration. (2008). *Wildlife-Vehicle Collision Reduction Study: Report to Congress*. Photo by Marcel Huijser, WTI. Retrieved July 14, 2011, from** http://www.fhwa.dot.gov/publications/research/safety/08034/05.cfm

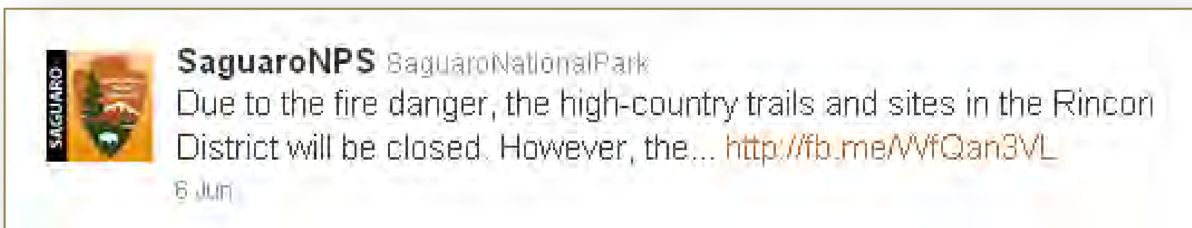
Shared Technologies: Establishing strong relationships with local, regional, and state agencies, such as state DOT's, local governments, regional planning organizations and public safety agencies fosters a collaborative environment in resolving transportation-related issues. Integrating unit information into regional or state 511 feeds or as part of a local or regional interactive trip planner leverages unit-level efforts to disseminate visitor information into part of a larger initiative. Additionally, transportation agencies and units have entered into agreements which have enabled the two entities to share technologies (DMS, HAR, CCTV) for multi-agency purposes), although there have likewise been instances where the state DOTs have been reluctant to engage. Regardless, many units must reach out to these agencies to erect a DMS or static sign or establish other ITS systems outside of unit boundaries. Under these relationships, the two parties are able to share best practices and solutions to both implementing ITS technologies and solving common transportation-related issues.

Traveler Information: Units could benefit from the development of a data management system which compiles data from multiple sources, analyzes the data, and disseminates the appropriate information to multiple outlets. This system accepts traveler information-related inputs from the unit, sensors within the unit and at nearby locations, and other sources (National Weather Service, 511 systems). The raw data or information is then processed and distributed to outputs such as highway advisory radio, DMS, a 511 system, a reverse 911 system, a unit's website, third party websites, smart phone applications, and other information dissemination platforms.

Taken individually, these technologies are relatively easy to update. However, distributing urgent information to multiple systems in a short amount of time can be overwhelming. This type of system would relieve staff members of juggling multiple responsibilities and enable the quicker distribution of data, especially in a time-sensitive situation such as an emergency (fire or road accidents are the most common). Units which have attempted to build comparable system have encountered internal firewall restrictions and most report an inability to build an automated system for dispersing information.

Social Media: Social media represents an untapped opportunity for public lands units to disseminate traveler and other visitor-related information. Many units are interested in using social media, such as Facebook, Twitter, and YouTube, to post information which enhances the visitor experience. Using these technologies, units can notify visitors of transportation-related delays, such as traffic congestion, parking lot closures, and road closures due to construction, weather, or fire. However, most successful social media sites are those that are developed for multi-functional purposes, such as distributing interpretive information.. The most time-consuming periods are during start-up, usually encompassing the first three to six months of operation. Once social media becomes a common practice, staff time commitments become reduced.

FIGURE 7 Public lands units can use Twitter to alert visitors of advisories in effect



Picture source: **Saguaro National Park. (2011). *Twitter post*. Retrieved July 13, 2011, from** http://twitter.com/SaguaroNPS

Findings Related to Approaching and Carrying Out ITS Projects

While ITS is commonly seen as an effective solution to addressing transportation issues for FLMAs, not all units turn to these technologies as an answer, as less expensive or easier to install resolutions are also considered in addition to ITS remedies. For those that do attempt to implement ITS, there are a number of methods to carry out projects, as well as common pitfalls that create issues during the implementation process. These findings concern the proclivity of public lands units to consider ITS schemes as a whole given their existing transportation issues, and evaluate how units carry out ITS projects.

Knowledge, Skills and Abilities: Units interested in deploying ITS technologies are often overwhelmed, both in terms of labor and expertise. Few public lands units devote staff members to work specifically with ITS technologies, particularly in smaller units with fewer employees. Staff interested in taking on an ITS project often must juggle planning, implementing, and operating technologies with other daily responsibilities. As a result, it is not uncommon for many ITS projects to be mired in delays due to the improper provisioning of staff resources to move it forward. Additionally, while an array of resources exist to assist units in operating ITS applications, many units remain unaware of them. Many unit personnel working with ITS feel that unless they enter into a formal relationship with a consultant or outside contractor, which can come at a great cost, they are otherwise left to their own devices. Units employing ITS technologies seek greater support than what their on-the-job training provides.

Contractor Assistance: Operating ITS through an outside contractor can be very beneficial for units. Frequently, unit staffs are unable to devote much attention to planning, implementing, or installing ITS technologies due to competing workload burdens. In addition, there is a lack of technical knowledge among public lands staff if systems malfunction. Contractors are able to remediate these proficiency issues, providing the time, attention, and expertise necessary to properly develop, maintain and operate ITS applications. By eliminating their own inexperience from the operation of these systems, unit staff can be more confident that their ITS technologies are being operated in a professional manner. An effective consultant also possesses the ability to guide units through the planning and implementation process, and can respond immediately to a maintenance issue if it arises. A third party contractor can also offer the opportunity to lease a system and assess its impact instead of purchasing it outright, although this type of relationship can come at a long-term cost.

Systems Engineering: For larger ITS projects, following a systems engineering process is essential. Complex systems, such as a traffic monitoring or parking management system, require staff, contractors, and other stakeholders to be on the same page throughout the process. Establishing systems engineering protocols from the outset of a project ensures that project responsibilities are clearly defined and expectations are agreed upon. Without a systems engineering process in place, mistakes made early in a project can snowball into bigger concerns later on, forcing expensive corrections and time delays. By employing a systems engineering process, parties are also better able to evaluate the feasibility of carrying out a project before work begins. A number of technologies planned for public lands units were scrapped when it became evident during the systems engineering process that project implementation and operational costs were much greater than initially planned.

Early Intervention Solutions: Units often have a higher tolerance for transportation issues such as traffic and parking congestion and may not seek ITS solutions "early". Many ITS needs assessments carried out for public lands units recommend a portfolio of ITS technologies to resolve transportation and other visitor management issues. However, many of these same units ultimately give little consideration to these suggestions. Some units have found that common transportation issues, such as traffic congestion or parking availability, do not appreciably detract from the visitor experience enough to justify the use of an ITS solution. In these instances, visitors have often accepted that delays and congestion will occur and have adjusted their travel plans to account for this. These types of conditions can both be central to a specific point of interest at a site (congestion will always occur, so visitors are used to it and will enjoy the slow ride) or be predictable to specific times (congestion will always occur on summer weekends, and visitors understand this). In these examples, ITS solutions, especially those that are large-scale systems, are seen as costly and unnecessary projects for units to take on.

Simple ITS Projects: Small-scale ITS projects, such as the provision of DMS or installation of traffic counters, offer the most cost-effective and straightforward solutions. Installation, operation, and continued maintenance of smaller ITS initiatives can be done with relative ease in comparison to more advanced systems. As use of these less complex, usually stand-alone technologies has become more prevalent among public lands units, a solid comprehension of the costs, mechanics, and best uses of these technologies has developed among many public lands staff as well as with their transportation agency counterparts. For example, roads staff at FLMAs now recognize that traffic counting loops are inexpensive to procure and install if coupled with a planned road paving project. Many units have taken the opportunity to install or recondition loops if roads are to be repaired as part of their normal maintenance.

FIGURE 8 Officials from Great Smoky Mountains National Park indicated that visitors have come to accept congestion along the Cades Cove Loop Road

Picture source: Blackerby, M. **(2008). Tour gives better look at Cades Cove's past, resources. *Knoxville News Sentinel.* Retrieved July 14, 2011, from http://www.knoxnews.com/news/2008/oct/25/looping-back-around/**

Comparison with 2005 Outlook

In comparing the former (2005) and current (2011) inventory tables, many of the technologies defined as being an identified need or in implementation planning from 2005 have not progressed beyond those stages, a trend not forecasted over a half decade ago. While marginally due to limited updated information on ITS project status in public lands, the stunted growth in ITS deployments also owes to projects being abandoned in the conceptual or planning stages of their development. Units may not possess the resources, whether it is funds, labor, or technical expertise, to carry projects forward as envisioned. As these obstacles are no less apparent now than they were in the mid-2000s, units must be vigilant about the potential delays which halt project advancement.

While common technologies such as HAR and DMS continue to enjoy widespread use in many units, the use of more comprehensive technologies such as traffic, parking, incident, and transit management systems remains light. Many of these types of multi-component ITS systems underwent demonstration tests in public lands units (primarily NPS units) in the early- to mid-2000s, with mixed results. Over the second half of the 2000s, few units have chosen to plan and implement either the components of these systems (such as automated road/weather information systems or vehicle tracking systems in transit vehicles) or the complete systems altogether. One explanation for this is that the need for more complex systems like these is not as great as the need for more simpler ITS applications. For instance, only larger units with sizable road networks would be in need of a traffic monitoring system. Many other units which could benefit from the introduction of such systems may be put off by the high cost of installation, as well as the technical difficulty involved with ongoing operations. There is now a great deal of information on the life cycle costs of these pieces of equipment, enabling individual units to better identify the full impact that these ITS deployments will have on a unit's capital and multi-year operating budgets. This has created hesitancy when a positive return on investment is not guaranteed.

Recommendations To Advance ITS Applications

As evidenced by the content of this report, although much progress has been made to raise the recognition and acceptance of ITS as an effective and reliable option to approach transportation problems within public lands units, there is still much effort needed to further advance ITS use in public lands. This section lays out recommendations to increase ITS exposure, enhance planning, and improve ITS operations for public lands units and FLMAs.

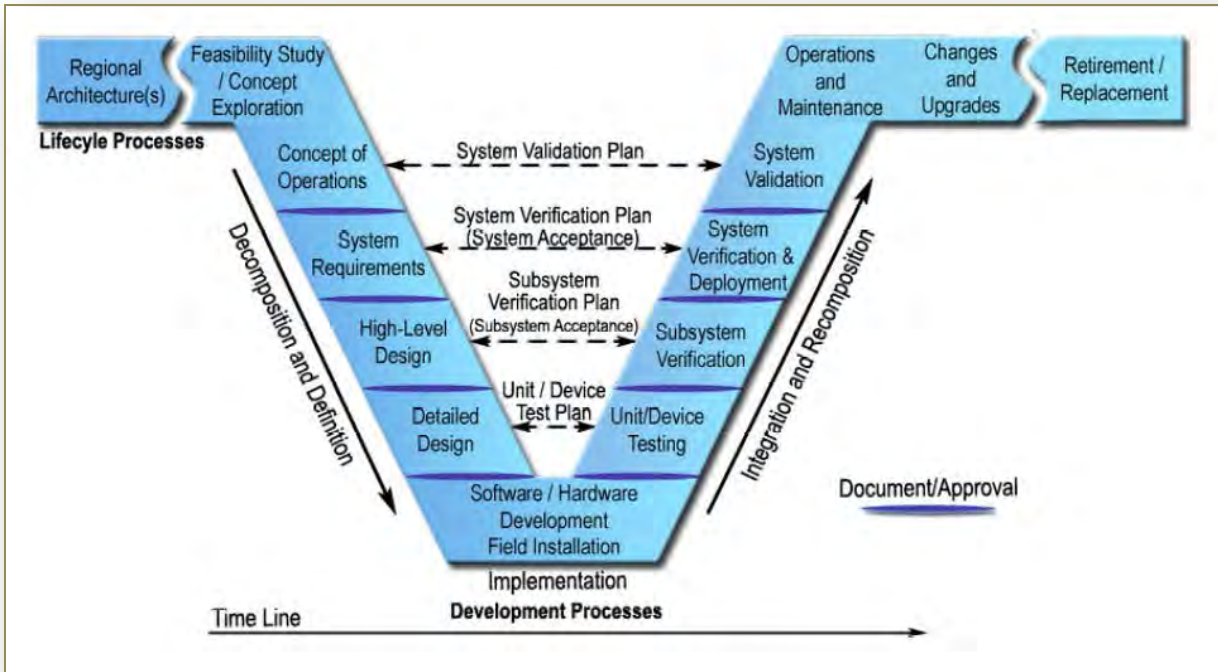
Unit Level

Scale Deployments: Consider small-scale ITS solutions first. Units with little to no background in operating ITS should be weary of jumping head first into far-reaching ITS projects. Although many of the major public lands sites (such as Yosemite and Yellowstone) extensively incorporate ITS into their operations out of necessity, it was noticed that many ITS needs assessments for smaller or medium-sized units recommended the incorporation of comprehensive ITS plans, put into action over a series of years and involving numerous separate components. According to discussions with public lands unit representatives, this all encompassing deployment could be a risky strategy for many sites, as the benefits accrued from some technologies may not rationalize the costs of installation and staff may not be readily available to sufficiently operate technologies. These types of units considering ITS should first turn to smaller-scale components, such as a DMS or social media application, to gather experience to judge whether further technologies are needed and if units are equipped to handle expanded ITS installations. Another option is to utilize contractors to demonstrate "test" systems in a controlled location to evaluate their use before deploying unit-wide transportation systems.

ITS Application Team: Ensure unit staff is available and willing to tend to ITS. The most effective ITS applications at units have significant "buy-in" from staff involved with system operation. While many units with ITS technologies typically have a "champion" to guide the process along, it was discovered that when those staff members most strongly involved with projects do not have additional support to assist in the development of systems, projects are difficult to advance. When system components threaten to disrupt the typical operations of a unit, it is not uncommon for significant backlash to develop against ITS and for implementation plans to stall. Strong staff buy-in is particularly critical when handling technologies where regular attention is necessary, such as HAR or social media technologies.

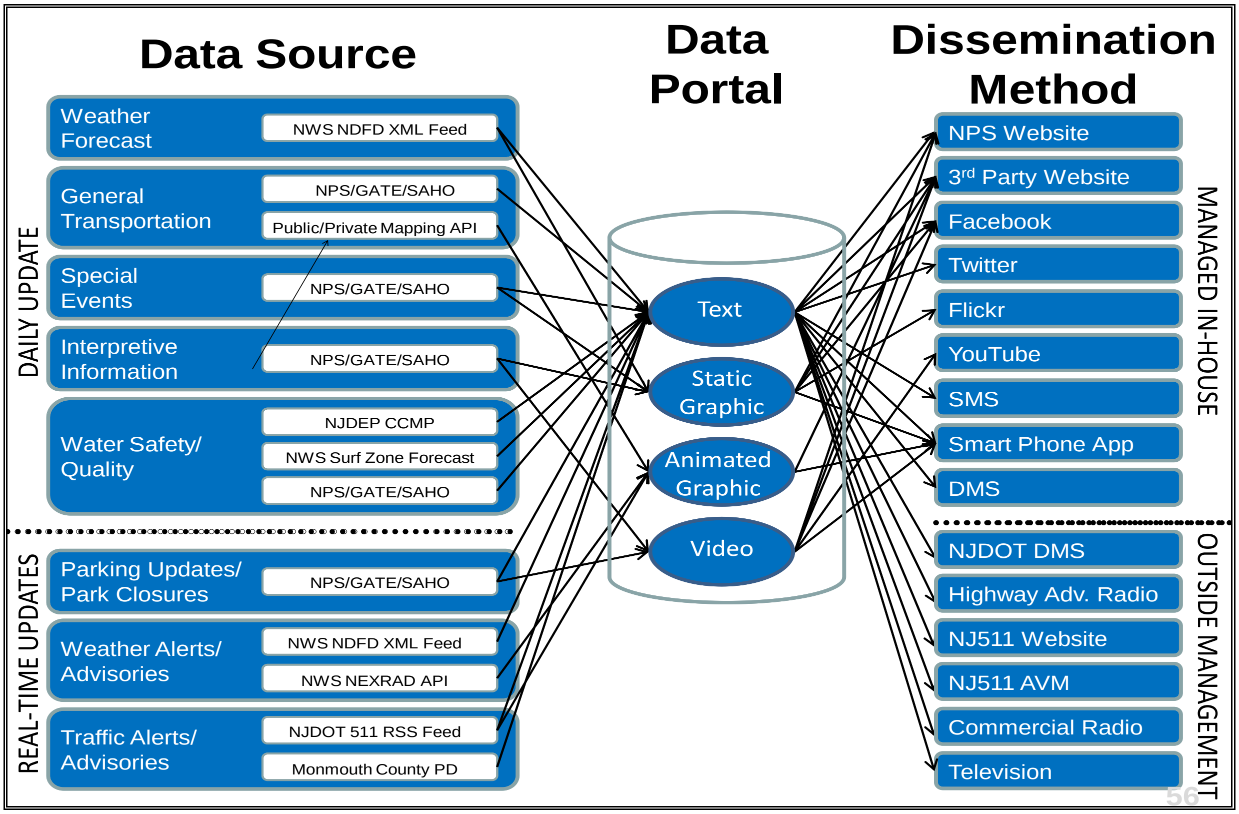
Systems Engineering: For larger ITS projects, follow a systems engineering process. Representatives from multiple units commented that various issues emerge stemming from improper design of systems and the absence of action plans to respond to system errors. This is compounded with larger-scale systems (transit, parking or traffic management systems), especially in the early installation stages. Following a systems engineering process can help establish responsibilities throughout all life stages of a project and verify how installation and implementation of a project will occur. The main purpose of such a method is to ensure that all project stakeholders are in concurrence, mistakes are kept to a minimum, and all anticipated system responsibilities are delegated from an early stage. This can greatly reduce the impact of project troubles in later deployment stages and during operations, as well as contribute to greater unity among all stakeholders. The systems engineering "V" graphic is presented in Figure 9.

FIGURE 9 Following a systems engineering process can help units anticipate and plan for potential issues arising during later stages of an ITS project



Picture source: **Federal Highway Administration and Federal Transit Administration. (2011). *Systems Engineering for Intelligent Transportation Systems: An Introduction for Transportation Professionals*. Retrieved July 14, 2011, from** http://www.ops.fhwa.dot.gov/publications/seitsguide/seguide.pdf

System Interoperability and Expandability: Design systems to work in conjunction with one another. While the majority of public lands representatives contacted espoused the value of deploying technologies at a level of need and staff capability, they also stressed that this should not limit the ability to eventually connect stand-alone components to create multi-application systems. Examples of this abound with traveler information technologies, where dispersing information on travel advisories may be best carried out through information blasts via a specific technology, social media outlet, or across all available technologies at a unit's disposal. A traveler information system that connects all the various dissemination components will provide the public lands unit with options on how to best direct this information. If there is a defined need for these multi-functional systems, then large-scale purchases of associated technologies can help streamline acquisition and installment costs, such as with a transit service seeking ITS solutions. It remains imperative to ensure these new components are interoperable with legacy systems and that any new system has expansion capabilities.



Picture source: **Jackson, D., Cotton, B., et al. (2010). *Sandy Hook Traveler Information System.* John A. Volpe National Transportation Systems Center. p. 7.**

State-of-the-Art Technology: Keep up with latest ITS technologies. The state of ITS technologies is in constant motion, with technologies losing relevance as others gain increased stature. It has been noted in this report that technologies which were once considered standard, such as HAR and 511 systems, are increasingly being replaced as primary information dissemination outlets due to the emergence of easily accessible wireless internet connectivity for visitors. This technological development has led to the emergence of social media applications as methods to communicate traveler-related and interpretive information. Ongoing communication with state DOTs or regional transportation entities, such as transit agencies or MPOs, provide a good opportunity for public lands staff to stay abreast of state-of-the-practice and state-of-the-art transportation technologies.

One example of a trending state-of-the-art ITS technology involves public lands units which have partnered with local transit agencies or other tourism interests to offer online trip planners, or have been linked into trip planners already in existence. Illustrating how easy visitors can access a unit using local transit services through a trip planner can increase visitation without straining parking and traffic concerns, as well as reduce vehicle emissions. Another example of successful partnering concerns trip planners which highlight various tourist attractions in an area. A leading example is the Core of Discovery, developed by a partnership between the Jefferson National Expansion Memorial (which includes the Gateway Arch), the Jefferson National Parks Association, and Metro, the

St. Louis area transit agency. The Core of Discovery offers an interactive online trip planner showcasing attractions in downtown St. Louis.[19]

FIGURE 11 The National Park Service is a partner of the Core of Discovery, an interactive trip planner for visitors of St. Louis

Picture source: **National Park Service, Jefferson National Parks Association, and Metro. (2011). *Core of Discovery home page*. Retrieved July 14, 2011, from** http://www.coreofdiscovery.com/

Friends Groups: Establishing robust relationships with friends groups and other external but closely-aligned organizations helps public lands units leverage their existing resources and enable the unit to seek wider solutions for transportation and visitor issues. Units with friends groups benefit strongly from the role that these organizations provide in marketing a site's amenities and volunteering time and resources. Often, these groups possess the effort and freedom to bring about improvements (both visitor-related and resource-minded) in instances where unit staff may be restricted or limited due to policy, staffing or budget. One particular instance of invaluable friends' assistance has been in the development and use of social media. Friends groups enjoy the liberty to host and sustain accounts on Facebook or Flickr to market unit attractions. Friends groups have been instrumental in advocating on a unit's behalf for ITS investments, supporting grant applications, and even providing funds and labor to supplement equipment operations and unit staff.

[19] National Park Service, Jefferson National Parks Association, and Metro. (2011). *Core of Discovery.* Retrieved March 30, 2011 from http://www.coreofdiscovery.com/.

Think Regionally with ITS Systems: Cooperation and communication with neighboring jurisdictions can be extremely beneficial to individual public lands units, especially in the development and operation of sophisticated transportation technologies and systems. With the exception of the most remote units, individual public lands units do not operate within an isolated transportation network. Ownership and responsibility may change, but the transportation infrastructure and support operations do not end at unit boundaries. Roads and transit systems travel through and around the public lands units, often connecting with gateway communities. A more expansive view of how cooperation and communication with the neighboring jurisdictions can be extremely beneficial to individual public lands units. Units should recognize the environs within which it operates and reach out to bordering entities to address transportation problems together. Simplistically, this recommendation, in three parts, urges units to: (1) share ITS equipment with other public entities, (2) piggyback on existing ITS equipment, and (3) integrate ITS planning and deployment with currently established planning efforts.

Share ITS Equipment with Other FLMA Units **-** With 391 NPS sites, 886 BLM sites[20], over 900 Fish and Wildlife sites, and 175 U.S. Forest Service sites[21], there are many locations where there are multiple federal (and state) public lands units in close proximity and access to these sites are on the same federal or state highways.[22] For example, in the southwest, Cochise County, Arizona is home to five BLM sites, third NPS sites, two FWS national wildlife refuges, and one USFS national forest.[23] Riverside County, California houses 13 BLM sites, two USFS sites, one NPS site, and one FWS site.[24] In the southeast, Cartaret County, North Carolina includes one NPS site, one FWS site and one USFS site.[25] Bount County, Tennessee contains the NPS' Great Smoky Mountains National Park; the USFS' Cherokee National Forest and Nantahala National Forest; and two Tennessee Valley Authority lakes - Fort Loudoun Lake and Tellico Lake. Proximate units or a regional body could cooperatively purchase, deploy, and operate the ITS components that would be beneficial for each of the units, such as a regional trip planner, various social media, and DMS on highway approaches to the public lands area.

Piggyback on Existing ITS Equipment **-** Various public lands units should become aware of what technologies are currently available or being planned by transportation entities in their region. It costs a unit minimal staff time to inquire if the existing ITS equipment owned and operated by neighboring jurisdictions could aid a unit's own transportation-related operations. As an example, a site and a state DOT could partner to post travel advisories related to unit operations on state-owned DMS along a corridor leading to a unit. This type of arrangement is

[20] Bureau of Land Management. (2009). *National Landscape Conservation System (NLCS) Count as of July 2009.* Retrieved November 16, 2009 from http://www.blm.gov/wo/st/en/prog/blm_special_areas/NLCS/summary_tables.

[21] 155 National Forests and 20 National Grasslands as of March 2011.

[22] There are thousands of other federal public lands that have not been directly included in this report. However, many of these recommendations are appropriate for any public lands units and the federal agencies that oversee their operations. These other public lands include over 700 recreation lakes and campgrounds under the U.S. Army Corps of Engineers, 58 parkways operated by the U.S. DOT, over 100 public recreation areas at 18 reservoirs under the Tennessee Valley Authority (TVA), over 1700 Marine Protected Areas managed by the National Oceanographic and Atmospheric Administration (NOAA), 49 sites overseen by the American Battle Monument Commission, 52 public sites under the National Archives and Records Administration, and other assorted recreation and public lands within the Bureau of Reclamation, the Bureau of Indian Affairs, and the Department of Defense.

[23] Cochise County, Arizona Public Lands units: BLM - Baker Canyon Wilderness Study Area, Dos Cabezas Mountains Wilderness, San Pedro Riparian National Conservation Area , Redfield Canyon Wilderness, Peloncillo Mountains Wilderness; NPS - Chiricahua National Monument, Coronado National Memorial, Fort Bowie National Historic Site; FWS - Leslie Canyon National Wildlife Refuge, San Bernardino National Wildlife Refuge; USFS - Coronado National Forest.

[24] Riverside County Public Lands units: BLM - Agua Tibia Wilderness Study Area, Beauty Mountain G Wilderness Study Area, Big Maria Mountains Wilderness, Chuckwalla Mountains Wilderness, Little Chuckwalla Mountains Wilderness, Mecca Hills Wilderness, Orocopia Mountains Wilderness, Palen/McCoy Wilderness, Palo Verde Mountains Wilderness, Rice Valley Wilderness, Riverside Mountains Wilderness, San Gorgonio Wilderness, Santa Rosa Wilderness; NPS – Joshua Tree National Park; FWS – Coachella Valley National Wildlife Refuge; USFS - Cleveland National Forest, San Bernardino National Forest.

[25] Cartaret County, North Carolina Public Lands units: NPS – Cape Lookout National Seashore; FWS - Cedar Island National Wildlife Refuge; USFS - Croatan National Forest.

already common for units connected into regional or state 511 systems. Partnerships with transit agencies or regional tourism interests to cooperatively use ITS components, especially for joint marketing of unit services, is also a common practice. In reality, any unit-related activities may be subservient to the equipment owners' operating policies, but any inquiries could be the first step toward increased coordination with state DOTs, transit, and other transportation entities. MPOs have proven useful in expanding regional communication and coordination leading to equipment sharing.

FIGURE 12 Public lands units can work with local DOTs to share ITS technologies such as dynamic message signs for unit-related activities

Picture source: **Paul S. Sarbanes Transit in the Parks Technical Assistance Center. (2011). *What is Alternative Transportation?*. Photo by Dr. Jonathan Upchurch. Retrieved July 15, 2011, from http://www.triptac.org/WhatIsTrans/Default.html**

***Integrate ITS Planning and Deployment with Regional Efforts* -** There are over 300 existing state, regional and corridor ITS architectures that direct where technology connections will occur. Many of these documents are included with regional or statewide ITS strategic plans which prioritizes and programs ITS components and systems. Public lands units are missing opportunities for regional coordination and assistance by not being more closely aligned with state and regional transportation planning efforts. Of the 92 ITS architectures reviewed for this study, only 19 instances of public lands involvement on a regional or statewide level could be cited. Moving forward, units considering ITS deployment must work with ITS stakeholders at the regional and statewide level to ensure implementation is properly coordinated and all possible efficiencies achieved. Documentation of roles and responsibilities for working partnerships between units and partner agencies are critical to ensure that duties are clear, obligations are kept, and project implementation is on time and on budget. An ancillary benefit to gaining public partners and inclusion in regional transportation plans (regional ITS architecture, six-year regional transportation improvement program (TIP) plan, four-year statewide transportation improvement program (STIP) plan) is the potential to gain support for funding requests and access to additional funding sources such as Transportation Enhancement (TE) and Congestion Management and Air Quality (CMAQ) funds.

National Level

Develop a National ITS Strategic Plan: Either a national ITS strategic plan for each FLMA or a single cooperative Federal Public Lands combined national ITS plan should be developed. An ITS strategic plan will enable systematic planning, procurement, implementation, operation and maintenance, and evaluation. This ITS Plan could be seen as a subset of the already extensive effort underway within the FLMAs to develop Long Range Transportation Plans (LRTP). A national plan will allow FLMAs to focus on those technologies that produce the greatest results for individual units and regions. A plan will provide agencies direction and could target various ITS technologies during each planning year, enabling uncomplicated reviews of similar deployment TRIP (and other) grant proposals. A cohesive and long-range ITS plan could facilitate nationally-based testing of cutting-edge ITS systems, as opposed to the reliance of a single unit to test the feasibility of a new system. As part of the testing, a National ITS Program could also sanction the movement of demonstration equipment to different sites to obtain better understanding of "need" and "benefit" for a variety of unit types.

Develop a National Social Media Program: By moving the technology deployment from individual units to a national effort, a concerted and consistent attempt to improve social media applications can be created. The use of social media applications has shown scattershot results in public lands units. Some units have spent an extensive amount of time developing a high quality product, while other units are either unable or unwilling to devote the time and effort needed to launch or improve these sites. A national program for social media development could work cooperatively with willing public lands units and provide initial (web-based) training available for all agency staffs. It is envisioned that a National Social Media Program could develop between 25 and 50 new social media outlets per year and increase the number of trained peers available to aid other public lands units.

Improve Procurement Processes: This recommendation is two-fold: first, consider multi-device procurements, and second, utilize existing federal government resources. Both propositions seek to respond to issues of capital costs, procurement speed, consistency with like products, proper maintenance of equipment, and staff training.

Mutli-Device Procurement: FLMAs should consider multiple item procurements of proven ITS technologies which could be allocated to several public lands units. Based on operational experience, prevalent ITS technologies, such as DMS and HAR, offer obvious benefits to their users in distributing information on traveler-related advisories to en-route visitors, among other uses. However, many individual units may be unfamiliar or unwilling to engage in the process of procuring such systems. For these commonly used and established technologies, FLMAs may want to consider purchasing a large number of individual devices to distribute to units which may request them, or to introduce systems to units which could benefit most from their inclusion. A national procurement is consistent with the next steps from a national ITS strategic plan and the suggested targeting of various ITS technologies. In addition to providing an economy of scale to obtain reduced per item cost, a single procurement for multiple public lands units could enable a single warranty and coordinated training and maintenance opportunities as part of the overall purchase contract.

Utilize the GSA-Approved Product List: The U.S. General Services Administration (GSA)[26] provides pre-approved standardized products at established prices. Utilizing this existing federal government resource could

[26] GSA's website notes that its "*acquisition solutions offer private sector professional services, equipment, supplies, telecommunications, and information technology to government organizations and the military. At GSA, we are committed to assisting Federal employees worldwide by meeting today's acquisition challenges. GSA Advantage!® is the government's premier*

provide lower equipment costs, expedite the procurement process, and improve the installation process (some prices listed include full installation). There are a number of relevant ITS equipment cited among the GSA product listings.

TABLE 2: GSA Listings of ITS Equipment[27]

GSA Listings of Intelligent Transportation Systems Equipment	
ITS Product	**Cost Range / Comment**
Mobile Data Terminal (MDT)	$200 to $2,700
Environmental Sensor Stations (ESS) / Weather Stations	$3,800 to $21,000
Highway Advisory Radio (HAR)	$30,000
Permanent light-emitting diode (LED) Changeable Message Sign (CMS)	$4,000 to $283,000
Portable Changeable Message Sign with Trailer	$7,700 to $16,000
Portable combined CMS and HAR with Trailer	$20,000 to $21,000
Small Scrolling LED Sign	From $300 (for entrance booth or visitors center)
CCTV Cameras	$55 to $83,000 (most expensive - infrared camera)
CCTV System	Up to $160,000 for CCTV system with control center Most cameras include several cameras (4) plus system components - wiring, software, links to control center
Vehicle GPS Location and Navigation Systems	Wide assortment of GPS and navigation components
Electronic Gates	Up to $50,000
Access Control and Credentialing Systems	Many diverse components and wide price variations

Provide and Expand ITS Knowledge, Skills, and Abilities: Institutional knowledge is paramount in successfully operating ITS, as staff unfamiliarity with technologies can impede willingness and aptitude to use systems. Although relatively few staff members at units are required to be well-versed in ITS knowledge to successfully operate systems, it is not uncommon for a large number of staff members to be called upon to work with ITS in some capacity. Lack of staff expertise in planning for and operating technologies is a significant obstacle to the spread of ITS throughout public land units. . This recommendation examines four methods to increase staff ITS knowledge, skills, and abilities: (1) training for staff, (2) ITS Professional Capacity Building (PCB) program, (3) peer exchanges, and (4) best practices road show.

Offer Training Opportunities for Staff - Offering training opportunities for staff, which will often not have time to seek out training opportunities on their own, could help close the knowledge gap and ensure that ITS technologies are being operated to their fullest potential. FLMAs may wish to conduct large-scale training sessions to reach greater numbers of participants.

Utilize ITS PCB Opportunities – In existence since 1996, the ITS Professional Capacity Building Program is the U.S. DOT's primary mechanism for educating the public sector transportation workforce about ITS. The ITS PCB uses a variety of methods to increase practitioners' knowledge – classroom training, webinars, peer interaction,

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online shopping system. With GSA Advantage!®, you'll have instant access to literally millions of high quality products, services, and solutions from thousands of approved commercial vendors."

[27] Cost ranges are from the GSA website. Access GSA Homepage at: https://www.gsaadvantage.gov/advantage/main/home.do. Retrieved 24 May 2011.

best practices videos, and coordination of curriculum offered by select colleges and universities. Webinars and other training components could be adapted for applicability for public lands agencies.

Conduct Peer Exchanges to Facilitate Information Sharing - The transportation issues which impact units can vary greatly by site characteristics, especially features related to geographic location or visitation levels. As such, the benefits of ITS in mitigating some of these concerns are not consistent across all units. Peer exchanges to facilitate knowledge sharing between units can help sites work towards applying the most effective functions of ITS. These exchanges may enable staff to learn of best methods to operate technologies which are most applicable to their local conditions. Valuable knowledge to exchange may include suitable technologies in particular settings, installation techniques, and successful approaches to equipment operation.

Share Best Practices and Create a Road Show – As previously stated, public lands staffs desire to learn from their peers and understand what was done right (and wrong) in ITS planning, deployment and operations. Best practices should be compiled and applied to a national program that stresses the need for regions, states, and public lands units to showcase and share their experiences for the benefit of others. This outreach could be enhanced through an ITS road show for public lands units. In addition to bringing deployment lessons and technology training directly to the regions as part of a developed road show, agency staffs could view a variety of ITS products and applications that may be useful to their individual units.

Technology Deployment Guidance

Because there are thousands of federal public lands units, each with its unique characteristics, it is impossible to identify a specific set of ITS technologies to aid in the transportation functions for each and all units. However, there are common characteristics that match a wide number of units. Appendix H is an effort to identify technologies that best fit public lands units based on specific characteristics covering:

- Visitation levels
- Congestion levels
- Parking
- Transportation options
- Entrances and road networks
- Regional context
- Geographic layout
- Other characteristics.

Based on input from interviews with federal lands representatives and other transportation experts, deployment trends, and documents assessing ITS technologies and deployments, each of the technologies or systems were ranked according to their fit with the characteristics of federal lands units. Ranking was listed I to III or not a necessity or applicable. A rank of I identified the technology or system as a key basic, core technology or providing a strong return-on-investment. A rank of II identified the technology or system as a useful, applicable technology and should be considered for use within a unit with the specific characteristic. A rank of III identified the technology or system as a technology or technical application that should receive some margin consideration, but should be deployed with a technical savvy staff. Staff capabilities and ongoing operations and maintenance requirements, availability of power sources, infrastructure needed, and capital costs were considered, especially when identifying core necessary technologies (rank I). The table below presents the generalities of which technologies are the best fit for each unit characteristic.

TABLE 3: Best Technology Fit for Public Lands Unit Type

BEST TECHNOLOGIES FIT FOR PUBLIC LANDS UNIT TYPE - 2011	
Characteristics	**Comment on ITS Technology**
Visitation Levels	
High (> 1M)	Almost all technologies should be of high consideration
Medium (500K-1M)	Wayfinding and congestion monitoring technologies are of most value
Low (< 500K)	Some wayfinding and traffic counting technologies are needed
>50% Repeat Visitors	Knowledgeable visitors require only social media contact and updates
>50% First Time Visitors	New visitors need multiple information sources & directional assistance
Overnight Stay Allowed	Parks should consider driving hazards reporting & visitor tracking techs
Day Visitors Only	Limited hour parks benefit from traffic counting & wayfinding/information techs
Congestion Levels / VMT	
LOS F	High traffic volumes benefit from wayfinding & vehicle tracking / monitoring systems
Many Miles @ LOS F	Locations with high traffic volume benefit from targeted tracking/monitoring systems
Many Weeks / Days of Week @ LOS F	Units with periods of sustained high traffic volume should consider increased use of traveler info & wayfinding assistance, along with tracking / monitoring systems
Many Incidents / Accidents / Events	Units with many events or high incident rates should consider wayfinding & tracking/monitoring systems
Parking	
Many Days above Capacity	High parking demands benefit from wayfinding, traveler info & parking management
High Level of Illegal "Unendorsed" Parking	Areas with excessive illegal parking should consider parking management and monitoring systems
Transportation Options	
Park-owned / Contracted ATS	ATS benefit from fare systems, passenger counters, vehicle tracking & traveler information
Public Transit	Wayfinding, traveler info, and fare systems simplify public transit access
Ferries	Visitor travel via ferry are improved with traveler info & fare systems
Entrance / Road Network	
Single Entrance / Exit	Units with one access point should consider technologies that provide traveler info & count travelers
Multiple Entrances / Exits	Units with more complex access points need to utilize more surveillance and monitoring systems for their multiple entrances and operations
Separate Staff / Other Entrance	No stand alone technologies are in critical need for staff entrances
Loop	Units with loop roads should consider traffic counter and traffic, fleet, weather & incident monitoring and management systems

BEST TECHNOLOGIES FIT FOR PUBLIC LANDS UNIT TYPE - 2011	
Characteristics	**Comment on ITS Technology**
Pass Thru	Units that contain "pass thru" roads should consider traveler info and traffic, weather & incident monitoring systems
Single Road	Units with a single road should consider technologies that provide traveler info, traffic counts and weather & incident management systems
Multiple Road	Units with a multiple road network should apply social media tools, vehicle tracking, and traffic & incident management systems
Regional Context	
Urban	Urban units benefit from social media, trip planning & transit system applications
Suburban	Suburban units benefit from trip planning, social media, and entry & fare systems
Rural	Rural units benefit from wayfinding & trip planning systems and traffic counters
Remote / Wilderness	Remote units benefit from wayfinding & trip planning systems, and traffic & passenger counters
Reserve / Preserve	Highly protected reserves and preserves benefit most from social media applications
Seashore	Seashore sites, usually with heavy traffic on limited space, benefit from multitude of travel & traffic mgmt systems, as well as road surveillance & incident management
Wilderness	Remote wilderness units benefit most from social media applications
Proximity to Interstate	
10 miles or less to Interstate	Units a short distance from interstate routes benefit from wayfinding technologies, traffic counters, parking management, and traffic & incident management systems
10-50 miles to Interstate	Units a moderate distance from interstate routes benefit from wayfinding, trip planning, traffic counters technologies
> 50 miles to Interstate	Units at least an hour from interstate routes benefit from trip planning, social media, road weather & traffic detection systems
Proximity to US Highway	
10 miles or less to US Highway	Units a short distance from highways benefit from select wayfinding technologies, traffic counters, parking management, and traffic & incident management systems
10-50 miles or less to US Highway	Units a moderate distance from highways benefit from trip planning and traffic counters technologies
>50 miles to US Highway	Units at least an hour from highways benefit from trip planning, social media, road weather & traffic detection systems
Geographic Layout/ Area	
Point (building / historic site)	Units encompassing a single facility benefit from the use of message signs (DMS), social media for traveler information and basic parking management systems.
Vast acreage	Units with vast area, too expansive to instrument to a valuable threshold, can still benefit from the use of trip planning and social media applications.
Linear	Linear units from which there are only one of two entrances and traffic flows are fairly consistent, would benefit from applying wayfinding and traveler info systems, as well as traffic counter and parking management systems.
Polygon	Irregular shaped units benefit from social media tools & inclusion in 511 systems.
High Elevation	Units with high elevations, subject to weather events, can benefit from weather information systems, as well as social media and 511 system inclusion.
Low Elevation	Units with low elevations, subject to potential flooding, can benefit from weather monitoring and info systems, as well as social media and 511 system inclusion.
Canyons / Heavy	The aesthetic appearance of many transportation technologies may be deemed to be in

BEST TECHNOLOGIES FIT FOR PUBLIC LANDS UNIT TYPE - 2011	
Characteristics	**Comment on ITS Technology**
Forests	conflict with historic and cultural resources; therefore, fairly hidden traffic counter and parking management systems as well as social media tools will provide the greatest use and conform within any visual limits.
Other	
Friends Group Available	Friends Groups are most advantageous in the development and use of the wide variety of social media
Gateway City / Town	Units with gateway communities get the most use from wayfinding & traveler information technologies and traffic & parking monitoring & management systems
Summer Peak	A wide variety of traffic & travel management, including road surveillance technologies, will aid summer peak traffic.
Winter Peak	A wide variety of traffic & travel management, including road weather information technologies, will aid winter peak traffic.
Climate / Adverse Weather	Units with extreme weather benefit from weather & traveler info systems, and traffic, work zone and incident monitoring & management systems
Satellite / Cell Reception Poor	Many technologies will not run as desired with poor reception; however, trip planning tools will be beneficial to travelers.
Historic / Cultural Restrictions	Historic and cultural restrictions many times limit the visual exposure (siting) of technologies, but parking management, traffic counters, and social media tools are the most hidden and useful technologies.
Agency	NPS / USFS / BLM / BIA / BOR / TVA / USACE (DOD)
	All agencies can benefit from social media applications
	NPS, FWS, TVA, BIA and *USACE* units contain a high number of public destination points and would benefit from DMS, 511 system, HARs and trip planners.
	Many *USFS, FWS, BLM, BOR* and *BIA* units are remote and/or in areas with harsh climates. They would benefit from road weather information systems.

Conclusion

Current Status of ITS in Public Lands

While ITS technologies continue to evolve and demonstrate positive results in transportation settings across the country, there is considerably less enthusiasm over ITS use in public lands. Many of the ITS technologies with the greatest utility for public lands, such as DMS, continue their growth in deployment for a number of different types of units. Technologies which are rapidly coming into use, particularly within the traveler information field, are considerably less complex and easier to manage than many multi-component systems. Complex operations, such as traffic monitoring, transit fleet management, and road-weather systems, are not providing the benefits to warrant deployments in locations where the transportation-related issues are not substantial.

Funding Outlook

With any ITS application, continuous investment is required throughout the lifecycle of the system to account for ongoing operations, maintenance, staff training, and if necessary, data collection, analysis, and archiving. Various complications can occur over the lifecycle of a project which requires staff attention and escalates expenses, such as power and connectivity issues or component failures. These events can be tied to damages incurred from weather events or other calamities, required updates to keep up with technological improvements, or normal and expected wear and tear of ITS equipment. Following a systems engineering process can identify the occurrence and magnitude of these costs from the outset of a project to its eventual replacement or component termination. By preparing for these costs ahead of time, units can ensure that reliable funding sources have been secured over the useful life of a technology.

Grant programs, such as the TRIP program, enable units to apply for funds towards planning studies and implementation projects with an aim towards easing transportation concerns related to their operations. These funds can be directed towards projects which instigate ITS activity, so long as these projects seek to achieve mode shift or reduce congestion or vehicle emissions. There are also regional transportation funds, such as CMAQ and TE funds, that may be available for public lands units to implement ITS applications that produce regional impacts beyond a unit's borders. As has been noted in this report, FLMAs should work towards logical and strategic investments into ITS activities. This rational investment should include offering training opportunities, creating regional technical maintenance arrangements, and developing bulk procurements of select technologies.

Outlook for Technologies in Park Settings Moving Forward

As innovations occur and visitor expectations shift, new ITS applications will emerge over the coming years to fill unmet needs for improved traveler information, expanded coordination of operations on the transportation network, and replacement of obsolete technologies. These types of changes have been seen since the last inventory table update in 2005 as travel information kiosks, a traveler dissemination tool still in common use by many public lands units today, has been undermined as a powerful ITS solution in place of social media applications, which can reach visitors in a more accessible manner. Social networking, improved operations communications, and expanded opportunities for field information and automated monitoring have all been the primary focus of ITS deployments in public lands over the past five years.

Through 2020, it is reasonable to expect that these processes will continue to occur. Social media applications are proliferating across FLMAs and may soon become a standard part of the pre-trip planning process, in much the same way that visiting a unit website is. FLMAs are increasingly encouraging their units to take up social media, drafting official policies and following the lead of key stakeholders in their agencies who have already jumped in. Innovative trip planning tools, which typically consist of cutting-edge web applications developed in partnership with other public lands units or local tourism or commercial interests, have surfaced as effective platforms for pre-trip information dissemination and as promotional tools. On the other hand, older technologies, such as HAR, will lose relevance as these technological innovations occur, and may risk becoming obsolete by the time the next inventory table update is undertaken. However, the relative simplicity of DMS and HAR may continue to appeal to public lands staffs that have limited time to dedicate to technologies.

It is also possible that technologies less active today may take on more prominent roles in unit operations as they evolve into more technologically sophisticated systems. For example, many units are concerned with rates of vehicle and wildlife collisions. Although there are animal warning detection systems on the market, their usefulness is tempered by the disruption flashing warning lights can have on the surrounding environment at night, particularly if systems are easily triggered. Improvements in this application over the coming years could lead to more units adapting this technology. Other technologies with strong purposes in a public lands setting but checkered results to date, such as automated fare gates and automated road/weather information systems, may see similar transformations moving forward.

It is with the stand alone and fundamental technologies, such as social media applications, where the strongest growth is expected to occur in the near future. Other technologies will require a concerted and cohesive national effort to obtain greater levels of deployment and recognized benefits. Test demonstrations of the most sophisticated transportation management applications (e.g., fleet, incident, traffic/congestion, parking, work zone, and safety management) are needed to increase ITS awareness and ensure that the benefits seen with installations by transportation and transit agencies are transferable to public lands. Until a national collaborative effort among FLMAs is developed that encourages these technologies through demonstrations and follow-up evaluations, systems that require multiple components to be connected and interoperable and external coordination for their efficient operation will probably not be deployed to any significant extent.

Appendix A—ITS Inventory in FLMA Units

TABLE A.1: Total Technologies Identified in Public Lands Units and Change in Levels of ITS Deployments - 2005-2011

Technology	Public Lands Units Reporting Some Activity					
	2011		2005		Change 2005 to 2011	
	#	%	#	%	# Units	% Units
Loop Detectors / Traffic Counters	27	28.7%	7	11.9%	20	285.7%
Dynamic Message Signs (portable & permanent)	25	26.6%	20	33.9%	5	25.0%
Trip Planning Tools (innovative)	22	23.4%	16	27.1%	6	37.5%
Highway Advisory Radio	21	22.3%	23	39.0%	(2)	(8.7%)
511 System Integration	18	19.1%	17	28.8%	1	5.9%
Operations & Fleet Management	2	2.1%	9	15.3%	(7)	(77.8%)
Integrated Traffic Monitoring System	10	10.6%	13	22.0%	(3)	(23.1%)
Vehicle Tracking System	5	5.3%	7	11.9%	(2)	(28.6%)
In-Vehicle Electronic Information	4	4.3%	3	5.1%	1	33.3%
Parking Management & Availability	9	9.6%	15	25.4%	(6)	(40.0%)
Automated Road-Weather Information System	8	8.5%	17	28.8%	(9)	(52.9%)
Automated Passenger Counters	3	3.2%	3	5.1%	0	0.0%
Work Zone Management	4	4.3%	3	5.1%	1	33.3%
Incident Management System	11	11.7%	12	20.3%	(1)	(8.3%)
Road Surveillance	10	10.6%	8	13.6%	2	25.0%
Automated Entry System	6	6.4%	10	16.9%	(4)	(40.0%)
Automated Fee / Fare Payment	3	3.2%	0	0%	3	--%
Coordinate with Other Agencies	30	31.9%	20	33.9%	10	50.0%
ITS Needs Assessment	39	41.5%	22	37.3%	17	77.3%
Number of Public Lands Units Included	**94**	**100%**	**59**	**100%**	**35**	**59.3%**
Total Technologies	**257**		**214**		**43**	**21.1%**

* Based on total number of surveyed public lands units reporting some ITS activity. In 2005, 59 units, primarily NPS units reported ITS activity. In 2011, 94 units reported ITS activity (more if social media activity was included). 2011 figures in this table include **only** the ITS activity that will result in operational ITS applications, not just stating a need for these technologies. To be included, the ITS component must be in the following phase: Operational, Under Deployment, or Funding Requested.

TABLE A.2: ITS Projects in Public Lands Units- Change in Development Phase Levels from 2005 to 2011

Deployment Phase	ITS Projects Reported in Public Lands Units					
	2011		2005		Change 2005 to 2011	
	#	%	#	%	# Units	% Units
Operational – Complete	211	49.4%	21	10%	190	904.8%
Some Activity – Planning / Implementation	46	10.8%	131	61%	(85)	(64.9%)
Concept – Stated Need	170	39.8%	62	29%	108	174.2%
Total ITS Projects	**427**	**100%**	**214**	**100%**	**213**	**99.5%**

FIGURE A.1: ITS in Public Lands Units by Technology Category and Development Phase Levels – 2011

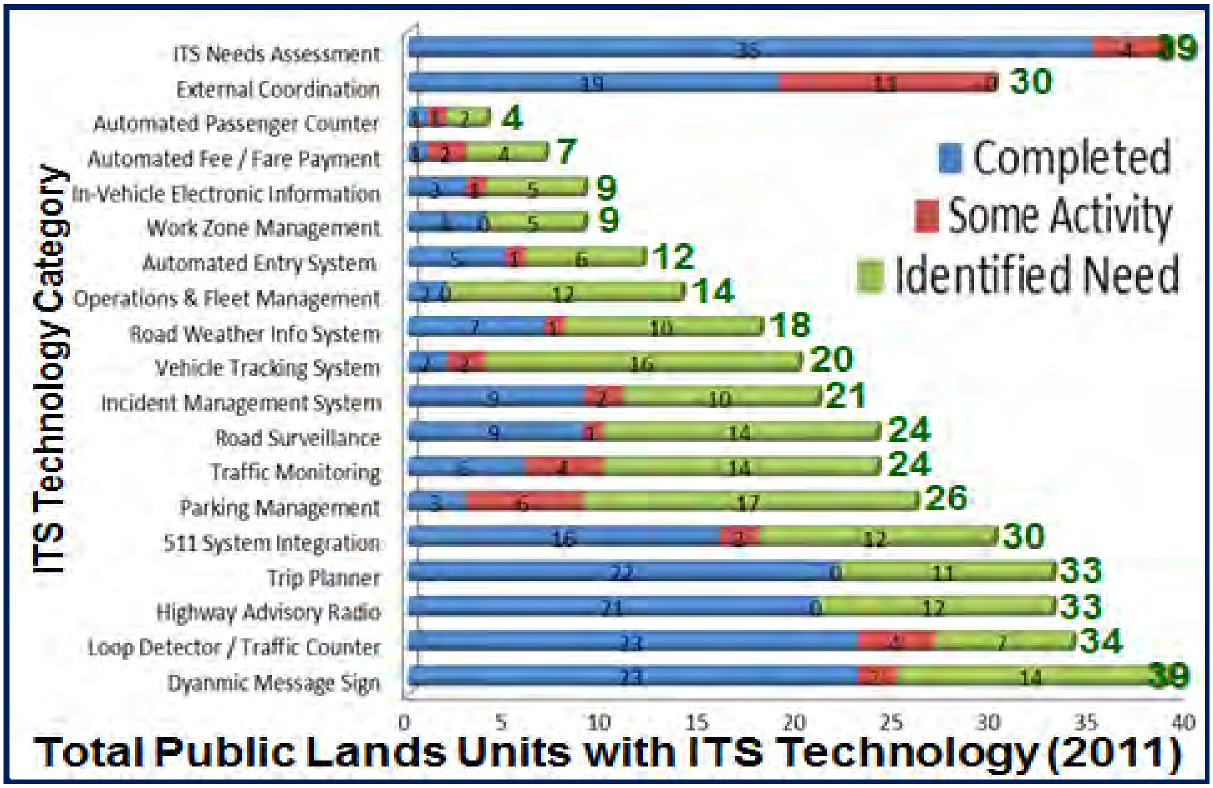
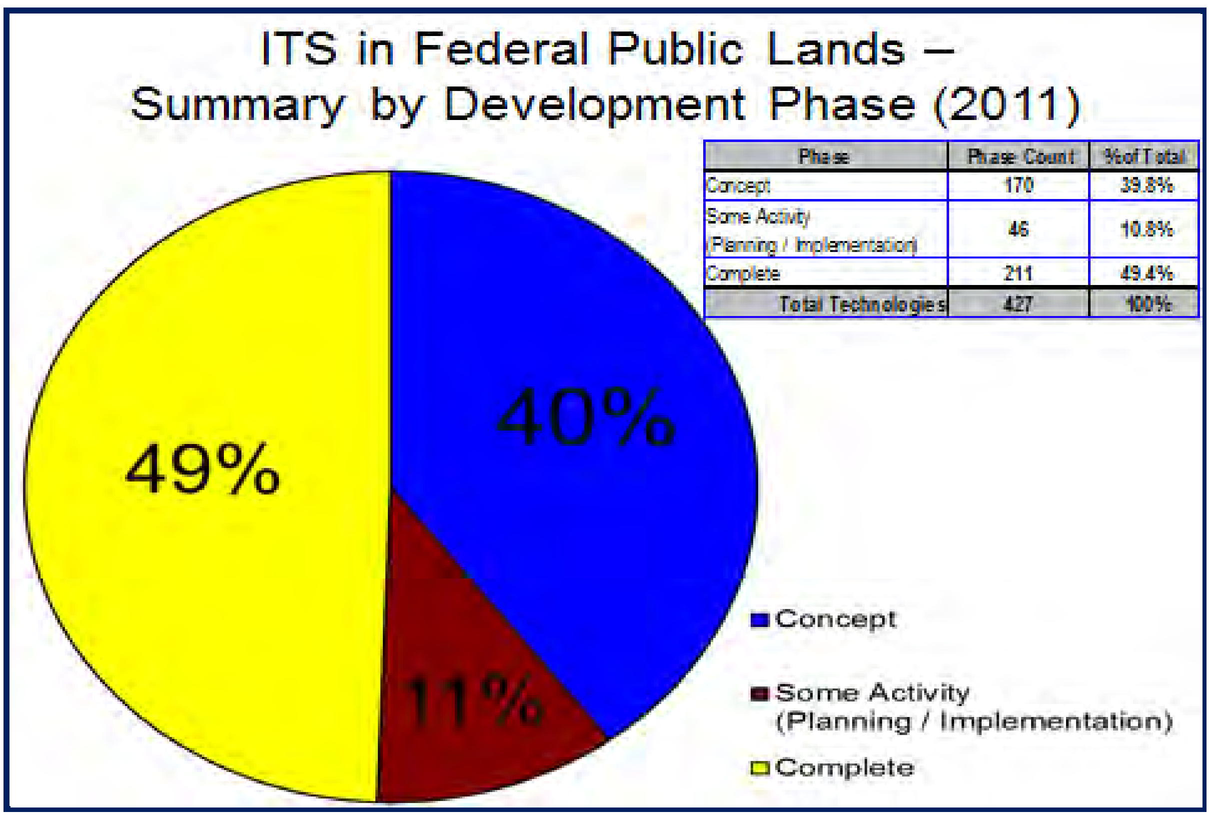


FIGURE A.2: ITS in Federal Public Lands Units by Development Phase – 2011



Phase	Phase Count	% of Total
Concept	170	39.8%
Some Activity (Planning / Implementation)	46	10.8%
Complete	211	49.4%
Total Technologies	427	100%

TABLE A.3: Traveler Information and Social Media Applications in Federal Public Lands (2011)

PUBLIC LANDS UNITS REPORTING TRAVELER INFORMATION / SOCIAL MEDIA (2011)					
UNITS REPORTING			PRIMARY SOCIAL MEDIA APPLICATIONS		
FLMA	# Units	Regional Use*	FLMA	Most Frequent	Second Most
Total	**197***	**32**	All Units	Twitter	Facebook
NPS	136	10	NPS	Twitter	Facebook
BLM	14	12	BLM	Facebook	YouTube
FWS	41	10	FWS	Facebook	Flickr
USFS	6	0	USFS	None	None

% OF ALL TRAVELER INFORMATION ITS APPLICATIONS CITED			TRAVELER INFORMATION				SOCIAL MEDIA APPLICATION								
			Dynamic Message Signs	511 System Integration	Highway Advisory Radio	Trip Planning Tools	Advanced Reservation Systems	Site Enhancements	Facebook	Twitter	Flickr	YouTube	Podcast / Webcast	Blogs	Media / Information
# Projects	**373**	**X**	**39**	**30**	**34**	**32**	**1**	**14**	**52**	**122**	**16**	**8**	**6**	**5**	**14**
TOTAL by Deployment Phase	**373**	**100%**	**20%**	**15%**	**17%**	**16%**	**0.5%**	**7%**	**26%**	**62%**	**8%**	**4%**	**3%**	**3%**	**7%**
Completed	**294**	78.8%	13%	8%	11%	11%	0.5%	4%	25%	61%	7%	4%	2%	3%	2%
Some Activity	**7**	1.9%	1.0%	1%	0.5%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Identified Need	**72**	19.3%	6%	6%	6%	6%	0%	3%	2%	1%	2%	0%	1%	0%	5%

* **Total Units** includes 32 FLMA regional or national offices

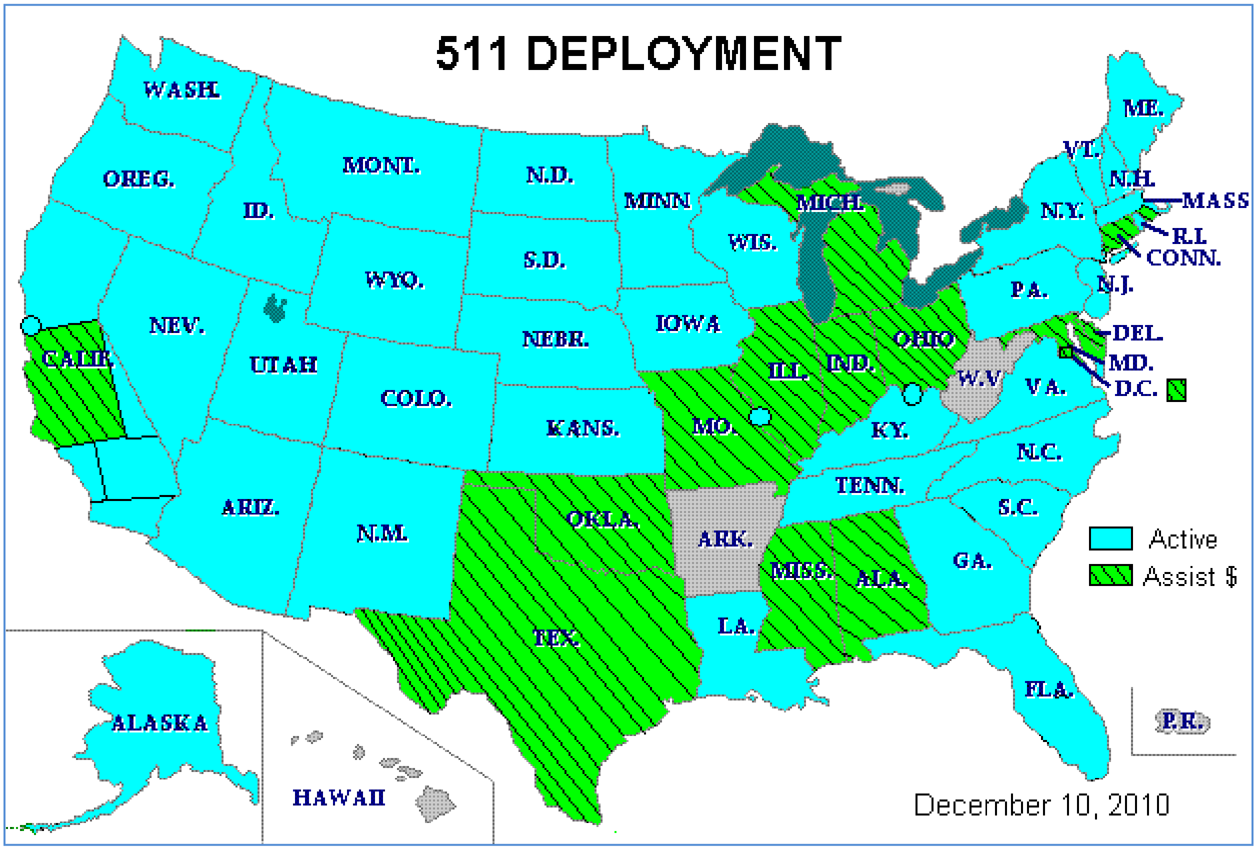
Reservation Systems are in use by many FLMA public lands units, but most are not linked to any advanced fee or fare systems

Site Enhancements include travel information kiosks, Quick Response (QR) Code, Near Field Communication (NFC), and unique audio or visual traveler information

Appendix B—511 Websites and Coverage Areas

511 Service	Date of Launch	511 Website
Alaska	April 25, 2003	http://511.alaska.gov
Arizona	March 20, 2002	www.AZ511.com
CALIFORNIA		
1) San Francisco Bay Area	December 6, 2002	www.511.org
2) Sacramento/No. California	September 1, 2004	www.sacregion511.org
3) San Diego	February 21, 2007	www.511SD.com
4) California Eastern Sierra	June 1, 2007	www.dot.ca.gov/dist9
Colorado	October 5, 2004	www.cotrip.org
FLORIDA		
1) Florida Metros (Ft. Lauderdale, Orlando, Miami, Jacksonville, Tampa)	June 24, 2002	www.fl511.com/
2) Southeast Florida	July 16, 2002	www.511southflorida.com
3) Tampa	September 2, 2004	www.511tampabay.com
4) Florida Statewide	November 17, 2005	www.FL511.com
5) Jacksonville	October 27, 2006	www.JAX511.com
6) Southwest Florida	April 11, 2007	www.southwestflorida511.com
Georgia	August 15, 2007	www.511GA.org
Idaho	November 22, 2005	http://511.idaho.gov
Iowa	November 15, 2002	www.511IA.org
Kansas	January 15, 2004	http://511.ksdot.org
KENTUCKY		
1) Cincinnati/Northern Kentucky	June 21, 2001	http://511.ky.gov/
2) Kentucky Statewide	November 26, 2002	www.511.KY.gov
Louisiana	December 24, 2006	www.511LA.org
Maine	May 15, 2003	www.511Maine.gov
Massachusetts	October 15, 2007	www.mass.gov/511
Minnesota	July 1, 2002	www.511MN.org
MISSOURI		
1) St. Louis	May 11, 2007	www.traffic.com/St-Louis-Traffic/St-Louis-Traffic-roads.html?AWOPARTNER=GATEWAYGUIDE
Montana	January 8, 2003	www.MDT511.com
Nebraska	October 1, 2001	www.511nebraska.org
Nevada	August 23, 2006	http://safetravelusa.com/nv
New Hampshire	May 15, 2003	www.nh.gov/dot/511
New Jersey	October 2007	www.NJ511.info
New Mexico	December 2007	http://nmroads.com
New York	November 16, 2008	www.nysdot.gov/main/511
North Carolina	August 25, 2004	www.NC511.com
North Dakota	February 10, 2003	www.state.nd.us/dot/divisions/maintenance/511_nd.html
Oregon	December 10, 2003	www.tripcheck.com
Rhode Island	March 9, 2005	www2.tmc.state.ri.us
South Dakota	November 22, 2002	www.sddot.com/511.asp
Tennessee	August 14, 2006	www.TN511.com
Utah	December 18, 2001	www.utahcommuterlink.com
Vermont	January 28, 2003	www.511VT.org
Virginia	I-81: February 19, 2002 Statewide:	www.511.virginia.org

511 Service	Date of Launch	511 Website
	February 15, 2005	
Washington State	September 16, 2002	www.wsdot.wa.gov/traffic/511
Wisconsin	December 18, 2008	www.511wi.gov/Web
Wyoming	July 1, 2006	www.wyoroad.info



Accessed May 20, 2011 - http://www.deploy511.org/deployment-stats.html

Appendix C—Statewide and Regional Architectures with Public Lands Involvement

The following table shows the statewide and regional ITS architectures reviewed which featured public lands involvement in some way. Public lands involvement varies among each instance. For example, the federal land management agency as a whole may be listed as a stakeholder, with no unit defined and no ITS technology cited. In other instances, a specific public lands unit may be named and its systems linked into broader regional and statewide responsibilities.

STATE	REGIONAL ARCHITECTURE NAME	REGION NAME	UNIQUE ITS ARCHITECTURE TITLE	NPS UNIT	STATE	REGIONAL
CA	Bay Area ITS Architecture	San Francisco-Oakland-Fremont MSA	Bay Area ITS Architecture	Golden Gate National Recreation Area (GGNRA)		X
CA	San Joaquin Valley Region ITS Strategic Deployment Plan	Fresno MSA	San Joaquin Valley Region ITS Strategic Deployment Plan	Sequoia and Kings Canyon National Park		X
CA	San Joaquin Valley Region ITS Strategic Deployment Plan	Fresno MSA	San Joaquin Valley Region ITS Strategic Deployment Plan	Yosemite National Park		X
CA	Statewide	Statewide ITS	California Statewide ITS Architecture and System Plan	National Parks and Forests	X	
DC	Washington DC Metro	Washington-Arlington-Alexandria DC-VA-MD-WV MSA	Washington, D.C. Regional ITS Architecture	National Park Service: BW Parkway, CAPWIN		X
ID	Statewide	Statewide ITS	Idaho Statewide ITS Architecture	USFS; BLM	X	
IL	Statewide	Statewide ITS	Illinois Statewide ITS Architecture	National/State Park and Recreation Areas	X	
MA	Southeastern Massachusetts	Barnstable Town MSA	Southeastern MA Regional ITS Architecture	NPS- Cape Cod National Seashore		X
MD	Statewide	Statewide ITS	Maryland ITS Arch	National Park Service	X	
ME	Statewide	Statewide ITS	Maine Statewide ITS Architecture	ACAD	X	
MS	Central Planning and Dev. Dist.	Jackson MSA	Central Region ITS Arch - Central Plng & Dev District	NPS; Natchez Trace Parkway		X
MT	Statewide	Statewide ITS	Montana Statewide ITS	Glacier NP	X	
MT	Statewide	Statewide ITS	Montana Statewide ITS	Yellowstone NP	X	
NJ	Statewide	Statewide ITS	New Jersey Statewide ITS Architecture	National Park Service	X	

STATE	REGIONAL ARCHITECTURE NAME	REGION NAME	UNIQUE ITS ARCHITECTURE TITLE	NPS UNIT	STATE	REGIONAL
NJ	South Jersey Trans. Plng. Org.	Trenton-Ewing MSA (Mercer County)	South Jersey-Delaware Valley Regional ITS Plan	National Park Service		X
NV	Southern Nevada	Las Vegas-Paradise MSA	Southern Nevada (RTC of So. NV)	USFS Humboldt-Toiyabe		X
UT	Dixie Regional ITS Architecture	St. George MSA	Dixie Regional ITS Architecture	Zion National Park		X
TN	Knoxville ITS Communication Master Plan	Knoxville MSA	Knoxville ITS Communication Master Plan	National Park Service		X
WV	Statewide	Statewide ITS	West Virginia ITS Arch	Harper's Ferry, River Gorge; USFS	X	

Appendix D—FLMA Units Interviewed

The following is a list of participants from the 13 NPS units and one USFS unit contacted for interviews to verify the content of the inventory table and discuss experiences with ITS. The interviews were conducted between September 2010 and February 2011. All individuals are employees of the FLMA unit unless otherwise noted.

National Park Service
Acadia National Park
Len Bobinchock, Deputy Superintendent
Frank Corrado, Traffic Operations Engineer, Federal Highway Administration
Tom Crikelair, Transportation Planner, Tom Crikelair Associates
Susan Moreau, Maine Department of Transportation
Paul Murphy, General Manager, Downeast Transportation Inc.

Arches National Park
Sabrina Henry, Planning and Compliance Coordinator

Bryce Canyon National Park
Daniel Cloud, Facilities Manager

Gateway National Recreation Area—Sandy Hook Unit
Jane Ahern, Public Affairs Division Acting Chief
James Grant, Project Management Division Chief
Pete McCarthy, Sandy Hook Unit Coordinator
Christine Miller, Telecommunications Equipment Operator
John Warren, Public Affairs Specialist
Sara Weimer, Park Ranger Supervisor

Great Smoky Mountains National Park
Teresa Cantrell, Community Planner
Kevin Fitzgerald, Deputy Superintendent
Dianne Flaugh, Cultural Resources Manager

Golden Gate National Recreation Area
Darren Brown, Transportation Planner

Grand Canyon National Park
Victoria Stinson, Project Manager

Grand Teton National Park
Chris Finlay, Facility Manager

Mount Rainier National Park
Bryan Bowden, Community Planner
Darin Swinney, GIS Specialist

Shenandoah National Park
Steve Herzog, Chief of Maintenance

Yellowstone National Park
Mike Angermeier, Landscape Architect
David Kack, Program Manager for Mobility and Public Transportation, Western Transportation Institute

Yosemite National Park
Jim Bacon, Outdoor Recreation Planner

Zion National Park
Jack Burns, Chief of Concessions Management
Karen Mayne, Zion Centennial Coordinator
Dave Webster, Budget Analyst
Jock Whitworth, Superintendent

United States Forest Service
Humboldt-Toiyabe National Forest
Hal Peterson, Project Manager
Andrew Tanner, Recreation Staff Officer

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Appendix F—ITS in NPS & Public Lands - 2011 Inventory Update

ITS in NPS & Public Lands - 2011 Inventory Update																					
U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management							Incident Management				Entry Mgt		Public Transportation Mgt				Other	
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	5) Loop Detectors / Traffic Counters	6) Integrated Traffic Monitoring System	7) Parking Management / Availability	8) Automated Road Weather Information System	9) Road Surveillance	10) Work Zone Management	11) Incident Management System	12) Automated Entry System	13) Automated Fee / Fare Payment	14) In-Vehicle Electronic Information	15) Vehicle Tracking System	16) Automated Passenger Counters	17) Operations & Fleet Management	18) Coordinate with Other Agencies	19) ITS Needs Assessment / ITS Architecture (Year)
National Park Service	Alaska	Denali National Park and Preserve				●	●										○		○		
		Alaska Region Parks		◒																	
	Intermountain	Arches National Park	○	○	○	●	●		○											◒	●
		Bryce Canyon National Park	●	●	●		●		◒				◒	●			◒			●	
		Glacier National Park	○	●	○	●	●	○	○	●		●				○	●		○	◒	●
		Grand Canyon National Park	●	●	●	●	●		○		●			●		●	◒	◒		●	
		Grand Teton National Park	●	●			●				●			○						●	●
		Petrified Forest National Park			●																
		Rocky Mountain National Park	●	●	●	●								●	●					●	
		Theodore Roosevelt National Park								●											
		Yellowstone National Park	●	●	●		●			○	✓		○	●			○		○	●	●
		Zion National Park	●	○	●	○								○	○	◒	◒	◒		●	’06
	Midwest	Cuyahoga Valley National Park	○			○											○				
		Indiana Dunes National Lakeshore	○	○		○		○	○		○		○								’11
		Jefferson National Expansion Memorial				●								●							
		Mount Rushmore National Memorial	●								●										

ITS in NPS & Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management							Incident Management				Entry Mgt		Public Transportation Mgt				Other	
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	5) Loop Detectors / Traffic Counters	6) Integrated Traffic Monitoring System	7) Parking Management / Availability	8) Automated Road Weather Information System	9) Road Surveillance	10) Work Zone Management	11) Incident Management System	12) Automated Entry System	13) Automated Fee / Fare Payment	14) In-Vehicle Electronic Information	15) Vehicle Tracking System	16) Automated Passenger Counters	17) Operations & Fleet Management	18) Coordinate with Other Agencies	19) ITS Needs Assessment / ITS Architecture (Year)
		Sleeping Bear Dunes National Lakeshore							○												
	National Capital	Baltimore-Washington Parkway	●				●	●					●							●	’05
	National Capital	George Washington Memorial Parkway						●		○			●							◒	
	National Capital	National Mall & Memorial Parks				○	●	●		○			●								◒
	Northeast	Acadia National Park	●	●			●	◒	◒		●					●	●	●	●	●	03/ ’05
	Northeast	Allegheny Portage Railroad National Historic Site		●	●																●
	Northeast	Blackstone River Valley National Heritage Corridor			●																◒
	Northeast	Boston Harbor Islands National Recreation Area				●															
	Northeast	Cape Cod National Seashore	●		○		●	○	○				○	○	○	○	○	○	○	●	’10
	Northeast	Delaware Water Gap National Recreation Area								●											
	Northeast	Gateway National Recreational Area	●	●	●	●	◒	●	✓		●	●	●	○	○	○	○	○	○	◒	’07
	Northeast	Gettysburg National Military Park	●				●		●												
	Northeast	Harpers Ferry National Historic Park		○						○	○	○	○						○		’06
	Northeast	National Parks of Massachusetts				●															
	Northeast	National Parks of New York Harbor				○															’08

ITS in NPS & Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management							Incident Management				Entry Mgt		Public Transportation Mgt				Other	
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	5) Loop Detectors / Traffic Counters	6) Integrated Traffic Monitoring System	7) Parking Management / Availability	8) Automated Road Weather Information System	9) Road Surveillance	10) Work Zone Management	11) Incident Management System	12) Automated Entry System	13) Automated Fee / Fare Payment	14) In-Vehicle Electronic Information	15) Vehicle Tracking System	16) Automated Passenger Counters	17) Operations & Fleet Management	18) Coordinate with Other Agencies	19) ITS Needs Assessment / ITS Architecture (Year)
		New River Gorge National River		○						○	○	○	○						○		’06
		Shenandoah National Park	○		●															◒	●
		Statue of Liberty National Monument																			◒
	Pacific West	Golden Gate National Recreation Area	●	●	●	●		◒	◒				○							●	●
	Pacific West	Lewis & Clark National Historical Park	●		●								●							◒	
	Pacific West	Mount Rainier National Park	◒	◒	●		●	◒			●						○		○	●	’07
	Pacific West	Muir Woods National Monument	●	●	○		○			●	○					○	○		○		’07
	Pacific West	Olympic National Park			●					◒										◒	●
	Pacific West	Point Reyes National Seashore		●													○				
	Pacific West	Redwood National & State Parks	●							●										◒	
	Pacific West	Santa Monica Mountains National Recreation Area				●															
	Pacific West	Sequoia and Kings Canyon National Park	○		●			○	○	○			○				○				●
	Pacific West	Yosemite National Park	●	●	●	○	●	○	○		●	●	●	●		●	○			●	
	Pacific West	Washington State NPS Parks		○																	
	Southeast	Blue Ridge Parkway		○		●														◒	
	Southeast	Cape Hatteras National Seashore	●					○	○		○									●	
	Southeast	Canaveral National Seashore						○	○		○										◒

ITS in NPS & Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management							Incident Management				Entry Mgt		Public Transportation Mgt				Other	
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	5) Loop Detectors / Traffic Counters	6) Integrated Traffic Monitoring System	7) Parking Management / Availability	8) Automated Road Weather Information System	9) Road Surveillance	10) Work Zone Management	11) Incident Management System	12) Automated Entry System	13) Automated Fee / Fare Payment	14) In-Vehicle Electronic Information	15) Vehicle Tracking System	16) Automated Passenger Counters	17) Operations & Fleet Management	18) Coordinate with Other Agencies	19) ITS Needs Assessment / ITS Architecture (Year)
		Carl Sandburg Home National Historic Site							◒					◒							
		Chattahoochee River National Recreation Area													◒						
		Chickamauga & Chattanooga National Military Park					●								●						
		Cumberland Gap National Park	●		●	●	●	●			●		●								
		Cumberland Island National Seashore		●																	
		Everglades National Park					●														
		Great Smoky Mountains National Park	●	●	●	●	●					●								●	●
		Gulf Islands National Seashore	●				●		●				●								
		Jean Lafitte National Historical Park & Preserve						○	○		○										
		Kings Mountain National Military Park						○	○		○										
		Martin Luther King, Jr. National Historic Site						○	○		○										
		Mammoth Cave National Park	●				●														
		Natchez Trace Parkway				●	●	○			○		●							●	’08

ITS in NPS & Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management							Incident Management				Entry Mgt		Public Transportation Mgt				Other	
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	5) Loop Detectors / Traffic Counters	6) Integrated Traffic Monitoring System	7) Parking Management / Availability	8) Automated Road Weather Information System	9) Road Surveillance	10) Work Zone Management	11) Incident Management System	12) Automated Entry System	13) Automated Fee / Fare Payment	14) In-Vehicle Electronic Information	15) Vehicle Tracking System	16) Automated Passenger Counters	17) Operations & Fleet Management	18) Coordinate with Other Agencies	19) ITS Needs Assessment / ITS Architecture (Year)
		Virgin Islands National Park	○																		
Bureau of Land Management	Alaska	Alaska Campbell Tract (Anchorage, AK)						●													
Bureau of Land Management	Alaska	White Mountains National Recreation Area				●															
Bureau of Land Management	Alaska	BLM-Alaska Office (Statewide)		●		●				○											
Bureau of Land Management	Nevada	Red Rock Canyon National Conservation Area	○	○	○	○	○	○	○		○		○				○		○	●	'09
Bureau of Land Management	Pacific	Yaquina Head Outstanding Natural Area																			'07
Fish & Wildlife Service	Great Lakes	Big Stone National Wildlife Refuge					●														
Fish & Wildlife Service	Great Lakes	Minnesota Valley National Wildlife Refuge				●															
Fish & Wildlife Service	Great Lakes	Seney National Wildlife Refuge					○														
Fish & Wildlife Service	Mtn Prairie	National Elk Refuge			●																
Fish & Wildlife Service	Mtn Prairie	Rocky Mountain Arsenal National Wildlife Refuge															○				
Fish & Wildlife Service	rth eas	Chincoteague National Wildlife Refuge	●		○		○				○										'10

ITS in NPS & Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management							Incident Management				Entry Mgt		Public Transportation Mgt				Other	
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	5) Loop Detectors / Traffic Counters	6) Integrated Traffic Monitoring System	7) Parking Management / Availability	8) Automated Road Weather Information System	9) Road Surveillance	10) Work Zone Management	11) Incident Management System	12) Automated Entry System	13) Automated Fee / Fare Payment	14) In-Vehicle Electronic Information	15) Vehicle Tracking System	16) Automated Passenger Counters	17) Operations & Fleet Management	18) Coordinate with Other Agencies	19) ITS Needs Assessment / ITS Architecture (Year)
		John Heinz National Wildlife Refuge at Tinicum				●															
		Monomoy National Wildlife Refuge																			’10
	Pacific	Kilauea Point National Wildlife Refuge	◒				◒		◒												‘09/ ’11
	Pacific	Oregon Coast Complex National Wildlife Refuge	○	○	○	○	○	○	○	○	○	○	○							●	‘09/ ’11
	Pacific	Tualatin River National Wildlife Refuge				●															
	Southeast	Harris Neck National Wildlife Refuge					○														
	Southeast	Pinckney Island National Wildlife Refuge					●														
	Southeast	Savannah Coastal Refuge			●		●														
	Southeast	South Arkansas National Wildlife Refuge Complex																		◒	
	Southwest	Balcones Canyonlands National Wildlife Refuge			●																
	Southwest	Lower Rio Grande Valley National Wildlife Refuge / World Birding Center / South Texas Refuge Complex																		◒	’07

ITS in NPS & Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	5) Loop Detectors / Traffic Counters	6) Integrated Traffic Monitoring System	7) Parking Management / Availability	8) Automated Road Weather Information System	9) Road Surveillance	10) Work Zone Management	11) Incident Management System	12) Automated Entry System	13) Automated Fee / Fare Payment	14) In-Vehicle Electronic Information	15) Vehicle Tracking System	16) Automated Passenger Counters	17) Operations & Fleet Management	18) Coordinate with Other Agencies	19) ITS Needs Assessment / ITS Architecture (Year)
			Travel & Traffic Management							Incident Management				Entry Mgt		Public Transportation Mgt				Other	
		Wichita Mountains National Wildlife Refuge	●		○		●	◒	○	○	◒	○	◒	○					◒	●	'09 /'11
US Forest Service	Inter Mountain	Humboldt-Toiyabe National Forest - Spring Mountains National Recreation Area	●	○	○	○	○	○	◒	○	○	○	○		◒				○	●	05/ '07
		Wasatch-Cache National Forest - Tri-Canyons Area															○		○		'07
	Pacific Northwest	Mount Baker-Snoqualmie National Forest	○	○	○	○															'07
		Mount Saint Helens National Volcanic Monument								●											
	Pacific Southwest	Inyo National Forest								●											
	Rocky Mtn	Arapaho-Roosevelt National Forest				●															
		White River National Forest - Maroon Bells Scenic Area														○	○				'07
	Southern	El Yunque National Forest	○		○				○												

ITS in NPS & Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management							Incident Management				Entry Mgt		Public Transportation Mgt				Other	
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	5) Loop Detectors / Traffic Counters	6) Integrated Traffic Monitoring System	7) Parking Management / Availability	8) Automated Road Weather Information System	9) Road Surveillance	10) Work Zone Management	11) Incident Management System	12) Automated Entry System	13) Automated Fee / Fare Payment	14) In-Vehicle Electronic Information	15) Vehicle Tracking System	16) Automated Passenger Counters	17) Operations & Fleet Management	18) Coordinate with Other Agencies	19) ITS Needs Assessment / ITS Architecture (Year)
	South west	Coronado National Forest / Sabino Canyon	O	O	O	O											O				'07
TOTAL PUBLIC LANDS WITH TECHNOLOGIES / SYSTEMS (94 Units)			39	30	33	33	34	24	26	18	24	9	21	12	7	9	20	5	14	30	39
	# Units with Tech Completed		23	16	21	22	23	6	3	7	9	4	9	5	1	3	2	1	2	19	35
	# Units with Some Activity		2	2	0	0	4	4	6	1	1	0	2	1	2	1	3	2	0	11	4
	# Units with Identified Need		14	12	12	11	7	14	17	10	14	5	10	6	4	5	15	2	12	0	0
% OF ALL PUBLIC LANDS WITH TECHNOLOGIES / SYSTEMS (94 Units)			41.5 %	31.9 %	35.1 %	35.1 %	36.2 %	25.5 %	27.7 %	19.1 %	25.5 %	9.6 %	22.3 %	12.8 %	7.4 %	9.6 %	21.3 %	5.3 %	14.9 %	31.9 %	41.5 %
	% of Units with Tech Completed		24.5 %	17.0 %	22.3 %	23.4 %	24.5 %	6.4 %	3.2 %	7.4 %	9.6 %	4.3 %	9.6 %	5.3 %	1.1 %	3.2 %	2.1 %	1.1 %	2.1 %	20.2 %	37.2 %
	% of Units with Some Activity		2.1 %	2.1 %	0.0 %	0.0 %	4.3 %	4.3 %	6.4 %	1.1 %	1.1 %	0.0 %	2.1 %	1.1 %	2.1 %	1.1 %	3.2 %	2.1 %	0.0 %	11. 7%	4.3 %
	% of Units with Identified Need		14.9 %	12.8 %	12.8 %	11.7 %	7.4 %	14.9 %	18.1 %	10.6 %	14.9 %	5.3 %	10.6 %	6.4 %	4.3 %	5.3 %	16.0 %	2.1 %	12.8 %	0.0 %	0.0 %
		NPS Units (62 Total)	30	24	22	22	22	19	20	12	19	6	17	11	6	8	15	4	10	24	26
		Completed	22	15	18	16	20	5	3	5	9	4	9	5	1	3	2	1	1	15	22
		Some Activity	1	2	0	0	1	3	4	1	0	0	1	1	1	1	2	1	0	9	4
		Identified Need	7	7	4	6	1	11	13	6	10	2	7	5	4	4	11	2	9	0	0
LEGEND:																	# Systems			% Total	

ITS in NPS & Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management: 1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	5) Loop Detectors / Traffic Counters	6) Integrated Traffic Monitoring System	7) Parking Management / Availability	Incident Management: 8) Automated Road Weather Information System	9) Road Surveillance	10) Work Zone Management	11) Incident Management System	Entry Mgt: 12) Automated Entry System	13) Automated Fee / Fare Payment	Public Transportation Mgt: 14) In-Vehicle Electronic Information	15) Vehicle Tracking System	16) Automated Passenger Counters	17) Operations & Fleet Management	Other: 18) Coordinate with Other Agencies	19) ITS Needs Assessment / ITS Architecture (Year)
		BLM Units (5 Total)	**1**	**2**	**1**	**3**	**1**	**2**	**1**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**1**	**1**	**2**
		Completed	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2
		Some Activity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Identified Need	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	1	0	0
		FWS Units (18 Total)	**4**	**1**	**6**	**4**	**10**	**2**	**3**	**2**	**3**	**2**	**2**	**1**	**0**	**0**	**1**	**0**	**1**	**4**	**6**
		Completed	0	0	3	3	3	0	0	0	0	0	0	0	0	0	0	0	1	2	6
		Some Activity	1	0	0	0	3	1	1	0	1	0	1	0	0	0	0	0	0	2	0
		Identified Need	3	1	3	1	4	1	2	2	2	2	1	1	0	0	1	0	0	0	0
		USFS Units (9 Total)	**4**	**3**	**4**	**4**	**1**	**1**	**2**	**3**	**1**	**1**	**1**	**0**	**1**	**1**	**3**	**0**	**2**	**1**	**5**
		Completed	1	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	1	5
		Some Activity	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
		Identified Need	3	3	4	3	1	1	1	1	1	1	1	0	0	1	3	0	2	0	0
		All Public Lands Units (94)	**39**	**30**	**33**	**33**	**34**	**24**	**26**	**18**	**24**	**9**	**21**	**12**	**7**	**9**	**20**	**5**	**14**	**30**	**39**

LEGEND:			
Essentially Complete or Complete	●	**Counted As Complete**	
Implementation Planning or Design		Test / Demo Underway	☑
Identified Need or System Plan	O	Test / Demo Completed	✓

Note: Activity is based on input from FLMA representatives or FLMA-sponsored documents.

	# Systems	% Total
Total Technologies	427	100.0%
Completed	211	49.4%
Some Activity	46	10.8%
Identified Need	170	39.8%

Appendix G—Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update

Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update															
U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management				Social Media Application								
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	Advanced / Automated Reservation Systems	Site Enhancements	Facebook	Twitter	Flickr	YouTube	Podcast / Webcast	Blogs	Other Social Media / Information Outlet
National Park Service	Alaska	NPS Alaska Region Parks		◒						●					
		Bering Land Bridge National Preserve								●					
		Cape Krusenstern National Monument								●					
		Denali National Park and Preserve				●				●					
		Gates of the Arctic National Park & Nat'l Preserve								●					
		Glacier Bay National Park & National Preserve								●					
		Katmai National Park								●					
		Kobuk Valley National Park								●					
		Lake Clark National Park								●					
		Noatak National Preserve								●					
		Sitka National Historical Park						●							
		Wrangell-St. Elias National Park & Preserve								●					
		Yukon-Charley Rivers National Preserve								●					
	Intermountain	Arches National Park	○	○	○	●									
		Arizona Trail National Historic Trail								●					
		Bandelier National Monument								●					
		Bryce Canyon National Park	●	●	●					●					
		Casa Grande Ruins National Monument								●					

Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management				Social Media Application								
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	Advanced / Automated Reservation Systems	Site Enhancements	Facebook	Twitter	Flickr	YouTube	Podcast / Webcast	Blogs	Other Social Media / Information Outlet
		Dinosaur National Monument								●					
		Florissant Fossil Beds National Monument								●					
		Glacier National Park	○	●	○	●			●	●	●		●	●	
		Grand Canyon National Park	●	●	●	●		●							
		Grand Teton National Park	●	●						●					
		Juan Bautista de Anza National Historic Trail								●					
		Lyndon B. Johnson National Historic Park								●					
		Petrified Forest National Park			●										
		Rocky Mountain National Park	●	●	●	●			●	●					
		Saguaro National Park								●					
		Theodore Roosevelt National Park								●					
		Yellowstone National Park	●	●	●					●					
		Zion National Park	●	○	●	○		○		●					○
	Midwest	Buffalo National River								●					
		Cuyahoga Valley National Park	○			○		●							
		Herbert Hoover National Historic Site								●					
		Homestead National Monument of America								●					
		Hot Springs National Park						●							
		Indiana Dunes National Lakeshore	○	○		○									○
		Jefferson Nat'l Expansion Memorial				●		●	●	●	●		●	●	●

Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management: 1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	Social Media Application: Advanced / Automated Reservation Systems	Site Enhancements	Facebook	Twitter	Flickr	YouTube	Podcast / Webcast	Blogs	Other Social Media / Information Outlet
		Jefferson National Parks Association							●	●					
		Jefferson National Expansion Memorial (Gateway Arch, Old Courthouse)							●	●					
		Ulysses S. Grant National Historic Site							●	●					
		Chippewa National Forest							●	●					
		Mississippi National River & Recreation Area							●	●					
		Voyageurs National Park							●	●					
		Lewis & Clark Visitor Center at Gavin's Point Dam							●	●					
		National Great Rivers Museum							●	●					
		Little Rock Central High School National Historic Site							●	●					
		Keweenaw National Historical Park								●					
		Mount Rushmore National Memorial	●												
		Niobrara National Scenic Riverway								●					
National Park Service	National Capital	Baltimore-Washington Parkway	●												
		Fort Stevens (Fort Circle Parks) - Rock Creek Park											●		
		George Washington Memorial Parkway											○		
		NPS National Capital Region Office								●					
		National Mall & Memorial Parks				○									
		US National Battlefields						●							

Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management: 1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	Social Media Application: Advanced / Automated Reservation Systems	Site Enhancements	Facebook	Twitter	Flickr	YouTube	Podcast / Webcast	Blogs	Other Social Media / Information Outlet
	Northeast	Acadia National Park	●	●											
		African Burial Ground National Monument								●					
		Allegheny Portage Raiload National Historic Site		●	●										
		Assateague Island National Seashore								●					
		Blackstone River Valley National Heritage Corridor			●										
		Boston Harbor Islands National Recreation Area				●									
		Cape Cod National Seashore	●		○										
		Chesapeake & Ohio Canal National Historical Park								●					
		Colonial National Historical Park								●					
		Ellis Island NPS								●					
		Federal Hall National Memorial								●					
		Fort Necessity National Battlefield								●					
		Gateway National Recreational Area	●	●	●	●		○	○	●	○		○		○
		General Grant National Memorial								●					
		George Washington Birthplace National Monument								●					
		Gettysburg National Military Park	●				●		●						
		Governors Island National Monument								●					
		Hamilton Grange National Memorial								●					
		Harpers Ferry National Historic Park		○						●					
		Hyde Park National Historic Sites								●					
		Johnstown Flood National Memorial								●					
		Lowell National Historical Park								●					

Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management: 1) Dynamic Message Signs (portable and permanent)	Travel & Traffic Management: 2) 511 System Integration	Travel & Traffic Management: 3) Highway Advisory Radio	Travel & Traffic Management: 4) Trip Planning Tools (Innovative)	Social Media Application: Advanced / Automated Reservation Systems	Social Media Application: Site Enhancements	Social Media Application: Facebook	Social Media Application: Twitter	Social Media Application: Flickr	Social Media Application: YouTube	Social Media Application: Podcast / Webcast	Social Media Application: Blogs	Social Media Application: Other Social Media / Information Outlet
		Morristown National Historic Park								●					
		National Parks of Massachusetts				●									
		National Parks of New York Harbor (NY Harbor Parks)				○				●					○
		New River Gorge National River		○											
		Niagara Falls State Park								●					
National Park Service		Richmond National Battlefield Park								●					
		Sagamore Hill National Historic Site								●					
		Shenandoah National Park	○		●					●					
		Statue of Liberty National Monument								●					
		Theodore Roosevelt. Birthplace Nat'l Historic Site								●					
		Thomas Stone National Historic Site								●					
		Valley Forge National Historical Park								●					
		Weir Farm National Historic Site								●					
	Pacific West	Alcatraz Island								●					
		Ala Kahakai National Historic Trail								●					
		American Memorial Park								●					
		Crater Lake National Park								●					
		Death Valley National Park								●					
		Fort Point National Historic Site (The Presidio)								●					
		Ft. Vancouver National Historic Site								●					
		Golden Gate National Recreation Area	●	●	●	●				●					

Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management: 1) Dynamic Message Signs (portable and permanent)	Travel & Traffic Management: 2) 511 System Integration	Travel & Traffic Management: 3) Highway Advisory Radio	Travel & Traffic Management: 4) Trip Planning Tools (Innovative)	Social Media Application: Advanced / Automated Reservation Systems	Social Media Application: Site Enhancements	Social Media Application: Facebook	Social Media Application: Twitter	Social Media Application: Flickr	Social Media Application: YouTube	Social Media Application: Podcast / Webcast	Social Media Application: Blogs	Social Media Application: Other Social Media / Information Outlet
		Haleakala National Park								●					
		Hawai'i Volcanoes National Park								●					
		Joshua Tree National Park								●					
		Kaloko-Honokohau National Historical Park								●					
		Lake Mead National Recreation Area								●					
		Lassen Volcanic National Park								●					
		Lewis & Clark National Historical Park	●		●										
		Mount Rainier National Park	◒	◒	●					●					○
		Muir Woods National Monument	●	●	○					●					
		The National Park of American Samoa								●					
		Olympic National Park			●										
		Pacific Islands National Parks								●					
		Point Reyes National Seashore		●											
		Pu'ukohola Heiau National Historic Site								●					
		Redwood National Park & State Parks	●							●					
		Santa Monica Mountains National Recreation Area				●				●					
		Sequoia and Kings Canyon National Park	○		●					●					
		USS Arizona Memorial								●					
		Washington State NPS Parks		○											
		Yosemite National Park	●	●	●	○				●					●

Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management				Social Media Application								
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	Advanced / Automated Reservation Systems	Site Enhancements	Facebook	Twitter	Flickr	YouTube	Podcast / Webcast	Blogs	Other Social Media / Information Outlet
National Park Service	Southeast	Biscayne National Park								●					
		Blue Ridge Parkway		○		●									
		Cape Hatteras National Seashore	●							●					
		Cumberland Gap National Park	●		●	●									
		Cumberland Island National Seashore		●											
		Dry Tortugas National Park								●					
		Everglades National Park								●					
		Fort Pulaski National Monument								●					
		Great Smoky Mountains National Park	●	●	●	●				●					
		Gulf Islands National Seashore	●							●					
		Mammoth Cave National Park	●							●					
		Natchez Trace Parkway				●									
		Timucuan Ecological and Historic Preserve								●					
		Virgin Islands National Park	○												
		Wright Brothers National Memorial								●					
	US	National Park Service (agency)								●					
		NPS Denver Service Center								●					

Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management: 1) Dynamic Message Signs (portable and permanent)	Travel & Traffic Management: 2) 511 System Integration	Travel & Traffic Management: 3) Highway Advisory Radio	Travel & Traffic Management: 4) Trip Planning Tools (Innovative)	Social Media Application: Advanced / Automated Reservation Systems	Social Media Application: Site Enhancements	Social Media Application: Facebook	Social Media Application: Twitter	Social Media Application: Flickr	Social Media Application: YouTube	Social Media Application: Podcast / Webcast	Social Media Application: Blogs	Social Media Application: Other Social Media / Information Outlet
Bureau of Land Management	Alaska	White Mountains National Recreation Area				●									
		BLM-Alaska Office		●		●			○	○	○				○
	AZ	BLM-Arizona Office								●					
	CA	BLM-California Office							●	●	●	●			
	CO	BLM-Colorado Office							●			●			
	ID	BLM-Idaho Office								●		●			
	MT	BLM-Montana Office							●						
	Nevada	Red Rock Canyon National Conservation Area	○	○	○	○									○
		BLM-Nevada Office							●			●			
	NM	BLM-New Mexico Office							●			●			
	OR	BLM-Oregon Office							●	●	●	●			
	UT	BLM-Utah Office							●						
	WY	BLM-Wyoming Office							●						
	US	Bureau of Land Management (agency)							●	●		●			

Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management				Social Media Application								
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	Advanced / Automated Reservation Systems	Site Enhancements	Facebook	Twitter	Flickr	YouTube	Podcast / Webcast	Blogs	Other Social Media / Information Outlet
Fish & Wildlife Service	AK	FWS Alaska Region							●		●				
	Great Lakes	FWS Great Lakes (Midwest) Region							●	●	●			●	
		FWS - Midwest US National Wildlife Refuges			◒			◒							
		Minnesota Valley National Wildlife Refuge				●		○							
	Mountain Prairie	FWS Mountain Prairie Region							●	●	●				
		National Elk Refuge			●										
		Rocky Mountain Arsenal National Wildlife Refuge													
	Northeast	Chincoteague National Wildlife Refuge	●		○										
		John Heinz National Wildlife Refuge at Tinicum				●									
		FWS Northeast Region							●	●	●				
	Pacific	Kilauea Point National Wildlife Refuge	◒												●
		Oregon Coast Complex National Wildlife Refuge	○	○	○	○									
		Tualatin River National Wildlife Refuge				●									
		FWS Pacific Region							●	●	●				
	Pacific Southwest	FWS Pacific Southwest Region							●	●	●				
	Southeast	Savannah Coastal Refuge			●			●							
		FWS Southeast Region							●	●	●				
		Southwest Louisiana Nat'l Wildlife Refuge Complex						◒							

Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management: 1) Dynamic Message Signs (portable and permanent)	Travel & Traffic Management: 2) 511 System Integration	Travel & Traffic Management: 3) Highway Advisory Radio	Travel & Traffic Management: 4) Trip Planning Tools (Innovative)	Social Media Application: Advanced / Automated Reservation Systems	Social Media Application: Site Enhancements	Social Media Application: Facebook	Social Media Application: Twitter	Social Media Application: Flickr	Social Media Application: YouTube	Social Media Application: Podcast / Webcast	Social Media Application: Blogs	Social Media Application: Other Social Media / Information Outlet
	Southwest	Balcones Canyonlands National Wildlife Refuge			●										
	Southwest	Lower Rio Grande Valley Nat'l Wildlife Refuge / World Birding Ctr / South Texas Refuge Complex				●									○
	Southwest	FWS Southwest Region							●	●	●			●	
	Southwest	Wichita Mountains National Wildlife Refuge	●		○			○							●
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Alabama Ecological Services Field Office							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Arctic NWR							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Ash Meadows NWR							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Cypress Creek NWR							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Detroit River International Wildlife Refuge							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Florida Keys NWR Complex							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Great River & Clarence Cannon NWR							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Iroquois NWR							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Kenai NWR							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Mingo NWR							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Minnesota Valley NWR							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Necedah NWR							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Okefenokee NWR							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	Prairie Wetlands Learning Center							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	San Francisco Bay NWR Complex							●						
Fish & Wildlife Service	National Wildlife Refuge - FACEBOOK	South Arkansas Refuges Complex							●						

Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management				Social Media Application								
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	Advanced / Automated Reservation Systems	Site Enhancements	Facebook	Twitter	Flickr	YouTube	Podcast / Webcast	Blogs	Other Social Media / Information Outlet
		St. Croix Wetland Management District							●						
		Upper Mississippi NWR							●						
	US	Fish & Wildlife Service (agency)							●	●	●	●	●	●	
US Forest Service	Inter Mtn	Humboldt-Toiyabe National Forest - Spring Mountains National Recreation Area	●	○	○	○									○
US Forest Service	Pacific Northwest	Mount Baker-Snoqualmie National Forest	○	○	○	○			○	○	○				○
US Forest Service	Pacific Southwest	Inyo National Forest													
US Forest Service	Rocky Mtn	Arapaho-Roosevelt National Forest				●									
US Forest Service	Southern	El Yunque National Forest	○		○										
US Forest Service	South west	Coronado National Forest / Sabino Canyon	○	○	○	○		○							

Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management				Social Media Application								
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	Advanced / Automated Reservation Systems	Site Enhancements	Facebook	Twitter	Flickr	YouTube	Podcast / Webcast	Blogs	Other Social Media / Information Outlet
Total Public Lands with Traveler Information / Social Media Applications (197 Units)			39	30	34	32	1	14	52	122	16	8	6	5	14
	# Units with Tech Completed		25	16	21	21	1	7	49	120	13	8	4	5	4
	# Units with Some Activity		2	2	1	0	0	2	0	0	0	0	0	0	0
	# Units with Identified Need		12	12	12	11	0	5	3	2	3	0	2	0	10
% of all Public Lands with Traveler Information / Social Media Applications (197 Units)			19.8%	15.2%	17.3%	16.2%	0.5%	7.1%	26.4%	61.9%	8.1%	4.1%	3.0%	2.5%	7.1%
	% of Units with Tech Completed		12.7%	8.1%	10.7%	10.7%	0.5%	3.6%	24.9%	60.9%	6.6%	4.1%	2.0%	2.5%	2.0%
	% of Units with Some Activity		1.0%	1.0%	0.5%	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	% of Units with Identified Need		6.1%	6.1%	6.1%	5.6%	0.0%	2.5%	1.5%	1.0%	1.5%	0.0%	1.0%	0.0%	5.1%
		NPS Units (136 Total)	**30**	**24**	**22**	**21**	**1**	**8**	**14**	**107**	**3**	**0**	**5**	**2**	**7**
		Completed	22	15	18	15	1	6	13	107	2	0	3	2	2
		Some Activity	1	2	0	0	0	0	0	0	0	0	0	0	0
		Identified Need	7	7	4	6	0	2	1	0	1	0	2	0	5
		BLM Units (14 Total)	**1**	**2**	**1**	**3**	**0**	**0**	**10**	**6**	**3**	**7**	**0**	**0**	**2**
		Completed	0	1	0	2	0	0	9	5	2	7	0	0	0
		Some Activity	0	0	0	0	0	0	0	0	0	0	0	0	0
		Identified Need	1	1	1	1	0	0	1	1	1	0	0	0	2

Traveler Information / Social Media in Federal Public Lands - 2011 Inventory Update

U.S. Public Lands Agency	Agency Region	Public Lands Unit	Travel & Traffic Management				Social Media Application								
			1) Dynamic Message Signs (portable and permanent)	2) 511 System Integration	3) Highway Advisory Radio	4) Trip Planning Tools (Innovative)	Advanced / Automated Reservation Systems	Site Enhancements	Facebook	Twitter	Flickr	YouTube	Podcast / Webcast	Blogs	Other Social Media / Information Outlet
		FWS Units (41 Total)	**4**	**1**	**7**	**4**	**0**	**5**	**27**	**8**	**9**	**1**	**1**	**3**	**3**
		Completed	2	0	3	3	0	1	27	8	9	1	1	3	2
		Some Activity	1	0	1	0	0	2	0	0	0	0	0	0	0
		Identified Need	1	1	3	1	0	2	0	0	0	0	0	0	1
		USFS Units (6 Total)	**4**	**3**	**4**	**4**	**0**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**2**
		Completed	1	0	0	1	0	0	0	0	0	0	0	0	0
		Some Activity	0	0	0	0	0	0	0	0	0	0	0	0	0
		Identified Need	3	3	4	3	0	1	1	1	1	0	0	0	2
		All Public Lands Units (197)	39	30	34	32	1	14	52	122	16	8	6	5	14

LEGEND:	
Essentially Complete or Complete	●
Implementation Planning or Design	◒
Identified Need or System Plan	○

	# Systems	% Total
Total Technologies	373	100.0%
Completed	294	78.8%
Some Activity	7	1.9%
Identified Need	72	19.3%

Notes: Activity is based on input from FLMA representatives or FLMA-sponsored documents.

Site Enhancements includes travel information kiosks; QR Codes; NFC (near field communications); and unique audio or visual traveler info.

Appendix H—Technology Deployment Guidance

Best Technologies Fit for Public Lands Unit Type - 2011

Unit Characteristics	Travel & Traffic Management									Incident Management					Entry Mgt		Public Transportation Mgt				Other		
	1) Dynamic Message Signs (portable)	2) Dynamic Message Signs (permanent)	3) 511 System Integration	4) Highway Advisory Radio	5) Trip Planning Tools (innovative)	6) Loop Detectors / Traffic Counters	7) Integrated Traffic Monitoring System	8) Parking Management / Parking Availability	9) Social Media Tools	10) Automated Road Weather Information System	11) Road Surveillance (Traffic Monitoring)	12) Work Zone Management	13) Incident Management System	14) Animal Warning Detection	15) Automated Entry System	16) Automated Fee / Fare Payment	17) In-Vehicle Electronic Information	18) Vehicle Tracking System	19) Automated Passenger Counters	20) Operations & Fleet Management	21) Coordinate with Other Agencies (Process)	23) ITS Needs Assessment / ITS Architecture (Document)	23) Asset Management System
Visitation Levels																							
High (> 1M)	I	I	I	I	I	I	I	I	I	I	I	II	I	III	II	I	II	I	I	I	I	I	I
Medium (500K-1M)	I	II	I	II	I	I	II	I	I	II	II	II	I	III	III	II	II	I	I	II	I	I	II
Low (< 500K)	II	III	I	III	II	I	III	II	I	III	III	III	III	II	X	III	III	II	II	III	II	III	III
>50% Repeat Visitors	II	II	II	III	III	II	III	II	I	X	III	II	II	III	II	II	III	III	II	III	X	III	X
>50% First Time Visitors	I	I	I	I	I	I	II	I	I	X	II	II	I	II	III	II	II	II	II	II	X	II	X
Overnight Stay Allowed	I	II	I	III	III	I	II	III	I	I	II	II	I	II	II	I	III	II	I	II	I	II	II
Day Visitors Only	I	I	I	I	I	I	II	I	I	X	II	III	II	X	III	II	II	II	II	II	II	III	II
Congestion Levels / VMT																							
LOS F	I	I	I	III	III	I	I	I	II	I	I	I	I	X	X	X	III	I	I	I	I	I	X
Many Miles @ LOS F	I	II	III	III	III	I	I	I	II	I	I	I	I	X	X	X	III	I	I	I	I	I	X
Many Weeks / Days of Week @ LOS F	I	II	I	III	III	I	I	I	II	I	I	I	I	X	X	X	III	I	I	I	I	I	X
Many Incidents / Accidents / Events	I	I	I	II	III	II	I	II	I	I	I	I	I	II	X	X	II	I	I	I	I	I	II
Parking																							
Many Days above Capacity	I	II	I	I	II	I	I	I	I	X	I	II	II	X	II	II	III	X	II	II	I	I	II
High Level of Illegal "Unendorsed" Parking	II	X		III	X	I	I	I	II	X	I	III	I	X	X	X	X	X	X	II	III	III	X
Transportation Options																							
Park-owned / Contracted ATS	I	II	III	I	I	I	II	II	I	II	II	X	II	X	I	I	I	I	I	II	I	II	II

Best Technologies Fit for Public Lands Unit Type - 2011

Unit Characteristics	Travel & Traffic Management									Incident Management					Entry Mgt		Public Transportation Mgt				Other		
	1) Dynamic Message Signs (portable)	2) Dynamic Message Signs (permanent)	3) 511 System Integration	4) Highway Advisory Radio	5) Trip Planning Tools (innovative)	6) Loop Detectors / Traffic Counters	7) Integrated Traffic Monitoring System	8) Parking Management / Parking Availability	9) Social Media Tools	10) Automated Road Weather Information System	11) Road Surveillance (Traffic Monitoring)	12) Work Zone Management	13) Incident Management System	14) Animal Warning Detection	15) Automated Entry System	16) Automated Fee / Fare Payment	17) In-Vehicle Electronic Information	18) Vehicle Tracking System	19) Automated Passenger Counters	20) Operations & Fleet Management	21) Coordinate with Other Agencies (Process)	22) ITS Needs Assessment / ITS Architecture (Document)	23) Asset Management System
Public Transit	I	I	I	II	I	II	II	II	I	II	II	X	II	X	I	I	I	I	I	II	I	III	III
Ferries	I	II	I	II	I	II	II	II	I	II	II	X	II	X	X	I	I	I	I	III	I	II	II
Entrance / Road Network																							
Single Entrance / Exit	I	II	I	I	II	I	II	III	I	II	II	II	I	X	II	II	III	III	I	I	II	III	X
Multiple Entrances / Exits	II	III	I	II	I	III	I	II	I	II	I	II	I	X	II	III	II	II	I	I	I	II	II
Separate Staff/Other Entrance	II	X	X	X	X	II	II	X	X	X	II	X	II	X	II	X	X	X	X	II	II	II	III
Loop	I	II	III	I	II	I	I	III	I	I	I	II	I	III	II	X	III	I	X	III	II	II	II
Pass Thru	I	II	I	I	I	I	II	III	III	I	II	II	I	II	X	X	X	II	X	III	I	II	III
Single Road	I	I	I	I	II	I	II	III	I	I	II	II	I	II	II	II	III	III	X	III	III	III	III
Multiple Roads	II	III	III	II	I	III	I	II	I	III	I	II	I	III	II	III	III	I	II	II	I	I	I
Regional Context																							
Urban	II	III	I	II	I	II	III	II	I	III	III	II	II		I	I	II	I	II	II	I	I	I
Suburban	II	III	I	I	I	II	II	II	I	III	II	II	II		I	I	II	II	II	II	I	I	I
Rural	I	II	I	III	I	I	II	II	I	II	II	III	II	III	II	III	III	III	II	II	II	III	III
Remote / Wilderness	I	II	I	III	I	I	II	II	I	II	II	III	II	II	II	III	III	III	I	III	III	III	X
Reserve / Preserve	II	III	III	III	II	II	III	III	I	II	III	III	II	II	II	X	X	III	II	III	III	III	II
Seashore	I	II	I	I	I	I	I	I	I	II	I	II	I	III	III	II	II	II	II	II	I	I	II
Wilderness	II	III	III	III	II	II	III	III	I	II	III	III	II	II	II	X	X	III	II	III	II	II	II
Proximity to Interstate																							
10 miles or less to Interstate	I	II	I	II	II	I	I	I	I	II	I	I	I	III	III	X	III	II	II	II	I	I	X
10-50 miles to Interstate	I	I	I	X	I	I	II	III	I	II	II	II	II	III	X	X	X	III	III	X	II	II	X
> 50 miles to Interstate	X	X	I	X	I	I	III	X	I	I	III	III	III	III	X	X	X	III	X	X	III	III	X

Best Technologies Fit for Public Lands Unit Type - 2011																							
	Travel & Traffic Management									Incident Management					Entry Mgt		Public Transportation Mgt				Other		
Unit Characteristics	1) Dyanmic Message Signs (portable)	2) Dynamic Message Signs (permanent)	3) 511 System Integration	4) Highway Advisory Radio	5) Trip Planning Tools (innovative)	6) Loop Detectors / Traffic Counters	7) Integrated Traffic Monitoring System	8) Parking Management / Parking Availability	9) Social Media Tools	10) Automated Road Weather Information System	11) Road Surveillance (Traffic Monitoring)	12) Work Zone Management	13) Incident Management System	14) Animal Warning Detection	15) Automated Entry System	16) Automated Fee / Fare Payment	17) In-Vehicle Electronic Information	18) Vehicle Tracking System	19) Automated Passenger Counters	20) Operations & Fleet Management	21) Coordinate with Other Agencies (Process)	23) ITS Needs Assessment / ITS Architecture (Document)	23) Asset Management System
Proximity to US Highway																							
10 miles or less to US Hwy	II	II	I	II	I	I	I	I	I	II	I	I	I	III	III	X	III	X	III	II	I	I	X
10-50 miles or less to US Hwy	II	II	I	X	I	I	II	III	I	II	II	II	II	III	X	X	X	III	III	X	II	II	X
>50 miles to US Highway	X	X	I	X	I	I	III	X	I	I	III	III	III	III	X	X	X	III	X	X	III	III	X
Geographic Layout / Area																							
Point (bldg / historic site)	I	I	I	II	III	III	III	I	I	X	III	III	II	X	III	II	II		III	III	I	I	I
Vast acreage	II	III	II	III	I	III	II	III	I	X	II	III	III	II	III	III	III	II	III	III	II	II	II
Linear	I	I	I	I	II	I	II	I	I	X	II	II	II	X	II	II	II	III	X	III	II	II	II
Polygon	II	III	I	II	II	II	II	II	I	X	II	II	II	X	III	III	III	II	X	II	II	II	II
High Elevation	II	III	I	II	X	II	II	X	I	I	II	II	II	II	III	X	X	III	X	II	X	X	X
Low Elevation	II	III	I	II	X	II	II	X	I	I	II	III	III	II	II	X	X	III	X	II	X	X	X
Canyons / Heavy Forests	II	X	III	II	I	II	III	II	III	I	III	II	II	II	III	X	X	X	X	II	X	X	X
Other																							
Friends Group Available	X	X	X	X	X	X	X	X	I	X	X	X	III	X	X	X	X	III	X	X	I	II	III
Gateway City / Town	I	I	I	I	I	I	II	I	I	X	II	I	II	X	X	X	X	III	II	III	I	I	II
Summer Peak	I	II	I	I	I	I	I	I	I	III	I	II	II	II	X	X	X	X	II	III	II	I	II
Winter Peak	I	II	I	I	I	I	I	I	I	I	I	II	II	II	X	X	X	X	II	III	II	I	II
Climate / Adverse Weather	I	II	I	I	I	II	I	II	I	I	I	I	I	II	II	X	III	II	II	II	I	I	I
Satellite / Cell Reception Poor	II	II	III	III	I	X	II	III	III	X	II	II	II	X	X	X	III	X	X	III	II	II	III
Historic / Cultural Restrictions	II	II	X	II	X	I	II	I	I	X	II	X	X	X	III	X	III	X	II	II	II	II	III

Best Technologies Fit for Public Lands Unit Type - 2011

Unit Characteristics	Travel & Traffic Management									Incident Management					Entry Mgt		Public Transportation Mgt				Other		
	1) Dynamic Message Signs (portable)	2) Dynamic Message Signs (permanent)	3) 511 System Integration	4) Highway Advisory Radio	5) Trip Planning Tools (innovative)	6) Loop Detectors / Traffic Counters	7) Integrated Traffic Monitoring System	8) Parking Management / Parking Availability	9) Social Media Tools	10) Automated Road Weather Information System	11) Road Surveillance (Traffic Monitoring)	12) Work Zone Management	13) Incident Management System	14) Animal Warning Detection	15) Automated Entry System	16) Automated Fee / Fare Payment	17) In-Vehicle Electronic Information	18) Vehicle Tracking System	19) Automated Passenger Counters	20) Operations & Fleet Management	21) Coordinate with Other Agencies (Process)	23) ITS Needs Assessment / ITS Architecture (Document)	23) Asset Management System
Agency																							
NPS	I	II	I	I	I	II	II	II	I	II	II	III	II	II	II	II	II	II	II	II	I	I	I
USFS	I	III	I	II	I	II	III	III	I	I	III	III	II	II	III	III	III	II	II	III	I	I	I
FWS	I	II	I	I	I	II	II	II	I	I	II	III	II	II	II	III	II	II	II	II	I	I	I
BLM	I	III	I	II	II	II	III	III	I	I	III	III	III	II	II	X	III	III	III	III	II	II	I
BIA	II	II	I	II	I	II	II	II	I	I	II	III	II	II	II	X	II	II	II	II	I	I	I
BOR	III	III	I	III	II	II	III	III	I	II	III	III	III	II	III	X	III	III	III	II	II	II	I
TVA	I	II	I	I	I	II	II	II	I	II	II	III	II	III	III	II	III	II	III	II	I	I	I
US ACE / DOD	I	II	I	I	I	II	II	II	I	II	II	II	II	III	II	X	III	II	III	II	I	I	I

LEGEND:

I - Technology or system is a key basic, core technology

II - Technology or system is useful and applicable and should be considered

III - Technology or technical application should receive some marginal consideration, but should be deployed by tech savvy staff

X - Technology or system is not a necessity or applicable